Three-View Layouts—Rickenbacker's Famous Spad Fighter—Aerial Machine-Guns

15¢ ★

MODEL AIRPLANE NEWS

AND JUNIOR MECHANICS

IN THIS ISSUE:

Co-2 Gas Engine Model Plans

"Canard" Flying Model Plans

All About Wartime Camouflage

SEPTEMBER, 1931

Model Airplane News and the Curtiss-Wright Flying Service invite you to enter the monster

Scrambled Picture Contest,

for which the prizes outlined below are offered

FREE:

A 10-hours Flying Course – 1st Prize

A Complete Ground Course – 2nd Prize

A 200-miles Cross-Country Flight – 3rd Prize

(SEE INSIDE FOR DETAILS)

"Casey" Jones, world-famous airman, who will be host-pilot on the cross-country flight

A Curtiss-Wright *Junior* in which our contest winner will be trained

One of America's Greatest Supply Houses

WORLD'S LOWEST PRICES—3-HOUR SUPPLY SERVICE

We Are Moving to New and Larger Quarters. Note Change in Address.

SCIENTIFIC BALSA

Scientific Balsa Wood is the lightest and best Balsa grown and is imported from South America. Model aeroplane experts at every corner of the globe have used our Balsa for both their flying and scale models. Scientific Balsa Wood is Kiln Dried-strait grained stock, especially prepared and cut to convenient usable sizes.

36" strips

1/16 x 1/16	.01	6 for .05
1/16 x 3/32	.01	6 for .05
1/16 x 1/8	.01	6 for .05
1/16 x 3/16	.01	6 for .05
1/16 x 1/4	.01	6 for .05
1/16 x 3/8	.02	6 for .10
1/16 x 1/2	.02½	7 for .15
1/16 x 3/4	.03	8 for .20
1/16 x 1	.03½	8 for .25
3/32 x 3/32	.01	6 for .05
3/32 x 1/8	.01	6 for .05
3/32 x 1/4	.02	6 for .10
3/32 x 1	.04	8 for .20
1/8 x 1/8	.01	6 for .05
1/8 x 5/32	.01	6 for .05
1/8 x 3/16	.01½	11 for .15
1/8 x 1/4	.02	6 for .05
1/8 x 5/16	.02	6 for .10
1/8 x 3/8	.02	6 for .10
1/8 x 1/2	.02½	6 for .12
1/8 x 3/4	.03	8 for .20
1/8 x 1	.04	8 for .30
1/8 x 1 1/2	.05	8 for .35
1/8 x 1 1/4	.04	8 for .30
1/8 x 1 3/4	.07	3 for .20
5/32 x 5/32	.02	6 for .10
3/16 x 3/16	.02	6 for .10
3/16 x 1/4	.02	6 for .10
3/16 x 5/16	.02	6 for .10
3/16 x 3/8	.02	6 for .10
3/16 x 7/16	.03	8 for .20
3/16 x 1/2	.03	8 for .20
3/16 x 3/4	.04	4 for .15
3/16 x 1	.05	6 for .25
1/4 x 3/16	.03	8 for .20
1/4 x 1/4	.02	6 for .10
1/4 x 5/16	.03	8 for .20
1/4 x 3/8	.04	8 for .30
1/4 x 1/2	.04	8 for .30
1/4 x 3/4	.04½	5 for .20
1/4 x 1	.06	6 for .33
5/16 x 5/16	.03½	8 for .25
3/8 x 3/8	.05	6 for .25
3/8 x 7/16	.05	6 for .25
3/8 x 1/2	.06	6 for .33
3/8 x 3/4	.06½	5 for .30
3/8 x 1	.10	3 for .25
7/16 x 7/16	.06½	5 for .30
1/2 x 1/2	.07	3 for .20
1/2 x 5/8	.10	3 for .25
1/2 x 3/8	.10	3 for .25
1/2 x 3/4	.10	3 for .25
1/2 x 1	.19	2 for .35
1/2 x 2	.35	3 for 1.00
1 x 1	.17	2 for .30
5/8 x 3/8	.05	6 for .25

40" strips

1/16 x 1/16	.01½	5 for .07
1/8 x 1/8	.02	6 for .10
1/8 x 3/8	.03	8 for .20
1/8 x 1/2	.03	8 for .20
1/8 x 3/4	.04	4 for .15
1/8 x 1	.05	6 for .25
3/16 x 3/8	.03	8 for .20
3/16 x 1/2	.04	4 for .15
1/4 x 1/4	.04	4 for .15
3/16 x 1/2	.04	4 for .15
1/4 x 1/4	.04	4 for .15
1/2 x 1/2	.09	3 for .25

SHEET BALSA—36" lengths

1/32 x 2"	.05	6 for .27
1/20 x 2"	.06	6 for .33
1/16 x 2"	.06	6 for .33
1/16 x 3"	.09	3 for .25
1/8 x 2"	.07	5 for .32
1/8 x 3"	.11	4 for .40
3/16 x 2"	.09	
3/16 x 3"	.12	3 for .33
1/4 x 2"	.11	4 for .40
1/4 x 3"	.17	3 for .48
3/8 x 2"	.16	2 for .30
3/8 x 3"	.20	3 for .55
3/32 x 2"	.07	3 for .20
3/32 x 3"	.11	4 for .40

PROPELLER BLOCKS

⅜ x ½ x 5	.01½	¾ x 1⅛ x 8	.03
⅜ x ¾ x 6	.01	¾ x 1⅛ x 10	.05
⅝ x ¾ x 7½	.02	¾ x 1⅛ x 11	.04
¾ x ¾ x 7½	.02	⅞ x 1½ x 11	.06
½ x ⅝ x 6	.01½	⅝ x 1¼ x 12	.06
½ x ¾ x 5	.02	⅞ x 1½ x 12	.07
½ x ¾ x 6	.02	1 x 1⅜ x 12	.08
⅝ x 1 x 7	.02	1 x 1½ x 13	.09
⅝ x 1 x 8	.02½	⅞ x 1½ x 14	.09
⅞ x 9/8 x 10	.03	⅝ x 1⅜ x 16	.12

PLANK BALSA

36" lengths

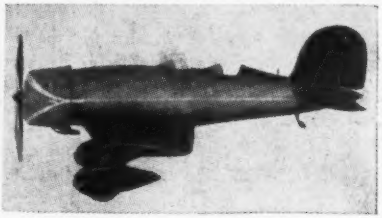
1 x 1½	.22	2 x 3	.60
1 x 2	.27	2 x 6	.90
1 x 3	.35	3 x 3	1.15
1 x 6	.60	3 x 6	2.20

BAMBOO

Strait-grained no-knot bamboo.

1/16 x ¼ x 12 long .... .01
Per dozen .... .08

TAKING THE COUNTRY BY STORM



LOCKHEED SIRIUS—CONSTRUCTION KIT

18" Wing Spread.

Contents of Kit: All wood parts cut to size. All wire parts formed. Tube of cement, rubber motor, true pitch propeller block, tissue, and full size plan.
Packed in an attractive box.

Postpaid $1.00

JAPANESE SUPER FINE TISSUE

Extra Super Fine Tissue. Used by expert model builders all over the country.
Sheet 18x24 .... .08

YOSHINO SILK TISSUE

A new tissue.
Sheet 18x24 .... .07

JAPANESE TISSUE

For the commercial ship.
Sheet 20½x24lb .... .05

SCALE MODEL TISSUE

For models that are to be covered with colored dopes.
Sheet 21x25 .... 2 for .05

JAPANESE TISSUE

Sheet 19¼x24¼ .... .04

REINFORCED HEAVY DUTY WINDERS

Each .... .35

CLEAR DOPE

This is genuine model aeroplane experts dope thinned down to meet the requirements of model airplane usage.
2 oz. bt. .... .10
Per pt. .... .75

COLORED DOPE

Real pigmented aircraft dope. Do not confuse this with dopes of inferior quality. Colors: International Orange, Galatea Orange, Fokker Red, Spartan Green, Silver, Loening Yellow, Curtiss Blue, Black, White. 2 oz. bt. .... .10
1 pt. .... .75

SCIENTIFIC DOPE THINNER

2 oz. .... .08
1 pt. .... .45

ACETONE

To thin out your heavier liquids.
2 oz. .... .08
1 pt. .... .45

AMBROID

Genuine Ambroid manufactured by the world's largest makers of ambroid. Used exclusively by the best model builders.
2 oz. .... .15
1 pt. 1.10

COLORLESS CEMENT

At last colorless cement that is all it should be. Used by experts at Detroit.
2 oz. .... .15
1 pt. 1.10

BANANA OIL

2 oz. bot. .... .08
1 pt. .... .45

CELLULOID WHEELS

Lightest and strongest wheels for model aeroplanes.

¾ diam. pr.	.06
1 diam. pr.	.07
1⅜ diam. pr.	.10
1⅞ diam. pr.	.15
3 diam. pr.	.30

ALUMINUM TUBING

⅛ outside diam. per ft. .... .07
3/16 outside diam. per ft. .... .10
¼ outside diam. per ft. .... .12

WASHERS

1/8 jar light indoor models, per dozen .... .01½c
per gross .... .15c
1/4 jar outdoor models, per dozen .... .01½c
per gross .... .15c

SHEET ALUMINUM

12" wide .005 per ft. .... .13
.010 per ft. .... .20

THRUST BEARINGS

Very light.
Large size .035 hole each .... .02—per doz. .... .20
Small size .025 hole each .... .02—per doz. .... .20

SCIENTIFIC "EXPERT" RUBBER

Scientifically prepared by the world's largest manufacturer of model aeroplane rubber.
Four sizes.

.045 sq.	4 ft. for .01	225 ft. skeins	.50
3/32 flat	3 ft. for .01	225 ft. skeins	.70
1.8 flat	3 ft. for .01	225 ft. skeins	.70
3.16 flat	2 ft. for .01	225 ft. skeins	1.00

DUMMY RADIAL ENGINES

9 cylinder dummy whirlwind motors made of celluloid 3" in diam. and very light each .... .33
Streamline Pants takes any wheel from 1" to 1⅞" diam. In perfect proportion with our N.A.C.A. cowlings. Price pr. $ .30.
N.A.C.A. Cowlings (black celluloid), each 23c

MUSIC WIRE

Strong, light, used by every model builder. Sizes: .014, .020, .028, .034; 15 ft. for .05.

PLANS

We carry a full line of plans for model aeroplanes, 10c each; 3 for 25c.
Fokker Amphibian, Lockheed Vega, S.E. 5 British Pursuit Plane, Stinson City of Chicago, Rocket Plane, Capt. Hawks Mystery Ship No. 13 Fokker Triplane. Many more are to be added to this list.

We also have the complete line of A.M.L.A. Scale Model plans. Each drawing is approximately 34"x44".

Boeing P-12 Pursuit	.20	Stinson Lycoming	.20
Vought Corsair	.20	Waco Taper Wing	.20
Fokker F-10	.20	Lockheed Sirius	.20
Lockheed Vega	.20	Spirit of St. Louis	.20

Add 5c when ordering separately.

Featherweight Compressed Air Motors

Finished tank 3"x3"x20" with 3 cylinder motor mounted. Tested ready for use, $7.25 complete.
Tanks for all model airplanes. 3x3x20" price, $4.00; 3x3x24", $4.50; 3x3x30", $5.00.
America's lowest price for a knockdown motor kit, all parts are ready to be assembled. They are drilled, formed and shaped to correct size. 1 set complete $.99.

IMPORTANT, ORDERING INSTRUCTIONS

Orders will absolutely not be filled unless you comply with instructions below.
1—Orders under $.25 will not be accepted.
2—Add $.15 for packing and postage on orders up to $1.50.
On orders of $1.51 and over add 10 per cent for packing and postage charges.
3—Add 10c extra to above charges on balsa blank orders less than $1.50 west of the Mississippi.

Canadian Charges.

Add 25c for packing and postage on orders up to $1.50. On orders of $1.50 and over add 15 per cent packing and postage.
4—Postage stamps. Canadian or Foreign Coin not accepted as payment.
5—Remit by check, postal or express money order. Make payment to Scientific Model Airplane Co., 277 Halsey Street, Newark, N. J.
6—Each and every article purchased from us is guaranteed to be of the highest standard.
7—All orders will be shipped 3 hours after receiving them.
8—Orders amounting to $4.00 and over are sent postpaid and insured. Under $4.00 and insurance payment to order.
Send 2c stamp for latest summer catalog containing world's lowest model aeroplane prices.
9—Add 10c more to orders West of Mississippi.

SCIENTIFIC MODEL AIRPLANE CO., 227 Halsey St., DEPT. N. J. Newark, N. J.

DEALERS AND CLUBS WRITE FOR SPECIAL PRICE LIST.

Model Airplane News

AND JUNIOR MECHANICS

Vol. V No. 3

Published by Harold Hersey

Edited by Capt. H. J. Loftus-Price

CONTENTS

SEPTEMBER, 1931

In Our Next Issue

Of course, we are going to remind you that there are two more pictures to unscramble in connection with our Monster Contest, for which we are awarding

A Free Flying Course
A Complete Ground Course
A 200-miles Cross-Country Flight

as first, second, and third prizes, respectively.

—::—

Ray Wardel continues his war covers with a beautiful reproduction of a *Friedrichshafen* (G3) German Bomber in authentic colors.

—::—

Next we have three great sets of plans: the Curtiss-Wright *Junior*, the Heath *Baby Bullet*—both flying models—and plans for constructing super-light wings for your models.

—::—

Then there are articles with photographs on the Kellett *Autogyro*, Sperry Gyroscope, and on the famous French ace, Guynemer.

—::—

Also there is a three-view layout of the famous wartime Sopwith *Camel* and more valuable photographs for your collection.

—::—

All this, to say nothing of the usual important courses.

—::—

Don't forget—"*Take a Course in Aviation for 15c a Month*" by reading MODEL AIRPLANE NEWS. On all news stands September 23, next. Order your copy now. Only 15c!

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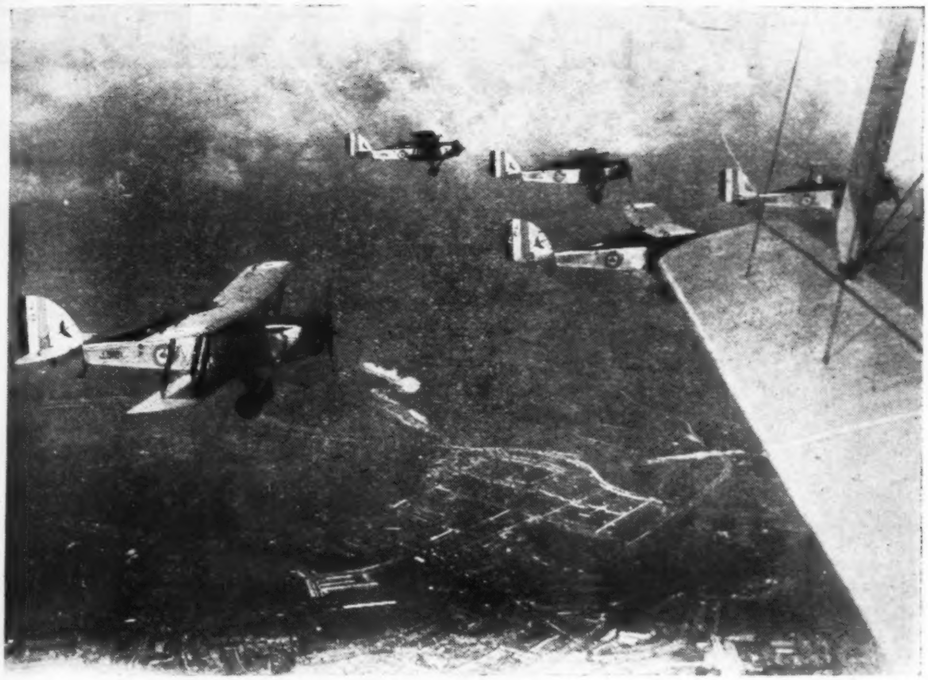
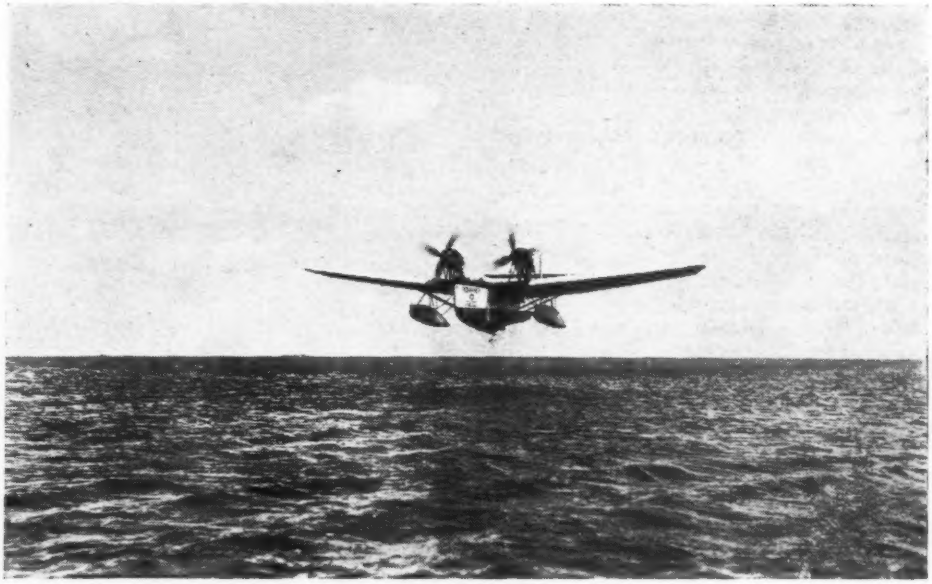
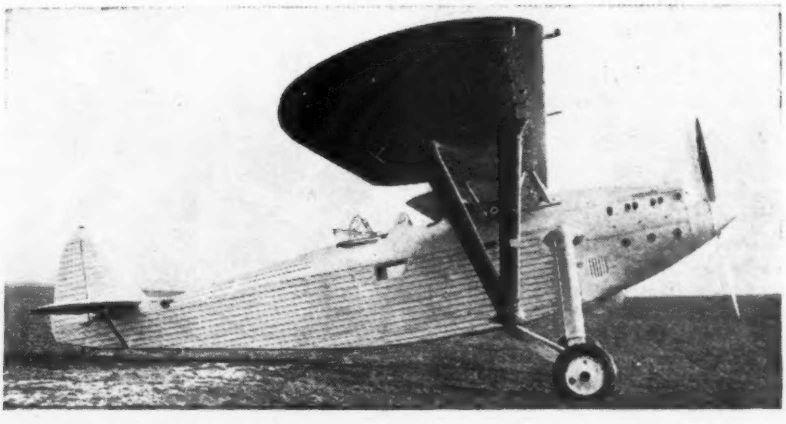


A GROUP of British Westland Wapiti two-seater fighter and observation planes flying in formation during recent maneuvers



AN all metal German Rohrbach Rocco flying boat seen just after the take-off on a flight from Travemunde to Sweden



A FRENCH Potez 39a2 two-seater fighter and observation plane. It is of all-metal construction and a speedy flyer

Win A FREE

WHAT YOU DO!

In brief—Unscramble the two scrambled pictures at the bottom of these pages, paste them neatly together and then thoroughly identify the planes they represent. Hold these two pictures until you have six in all—two in the next issue of Model Airplane News and two in the November issue. Then send in all six pictures for judging, remembering that NEATNESS and ACCURACY will play a large part in your success. Read the full details in this article!

A picturesque view of a Curtiss-Wright *Junior* the type of airplane in which the winner of the first prize will be trained

WELL, have we or have we not surprised you beyond your wildest imaginings this month? Did you ever expect anything like this? We'll bet you didn't!

That point settled, shall we say, let's get down to business.

About this monster Scrambled Picture Contest. Actually it's simple—very simple indeed, if you know your skyways, and if you have good eyesight, which is one of the chief attributes of a good airman.

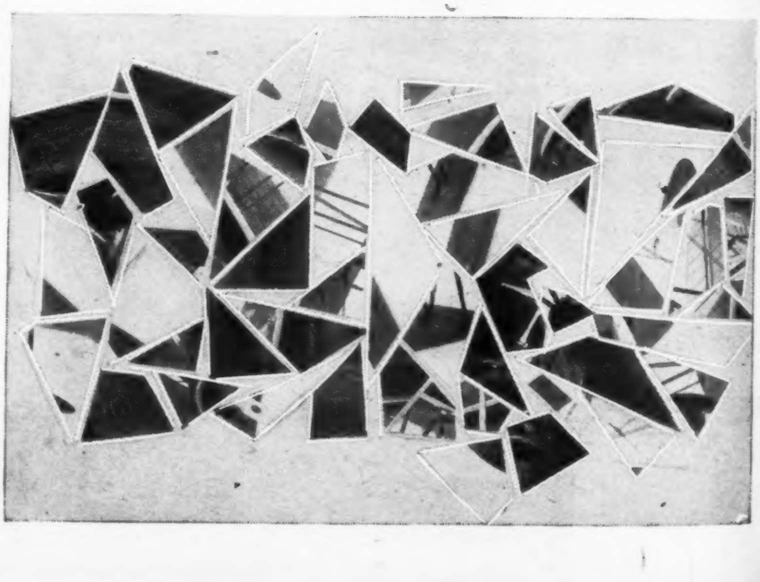
You know what scrambled eggs are, of course. Well, the contest is very much like scrambled eggs, except that we're going to scramble some planes instead of eggs. However, the result is the same.

First let us impress you greatly with the fact that you must read the rules carefully, and also that all signatures must be attached to entry blank. Remember that—ALL signatures are a prerequisite to bona fide entry in this contest.

Now! MODEL AIRPLANE NEWS in conjunction with the *Curtiss-Wright Flying Service,* renowned as the best and outstanding flying school in the United States, for some time have realized that the youth of the present generation (that is you fellows who read this, in particular) are the real stand-by for the future of aviation.

It is conceded without question that the boy of today knows far more about aviation than the older people, and it is our desire as much as anything else to make the older people realize through the efforts of the boy exactly what aviation means and what it will mean in the years to come.

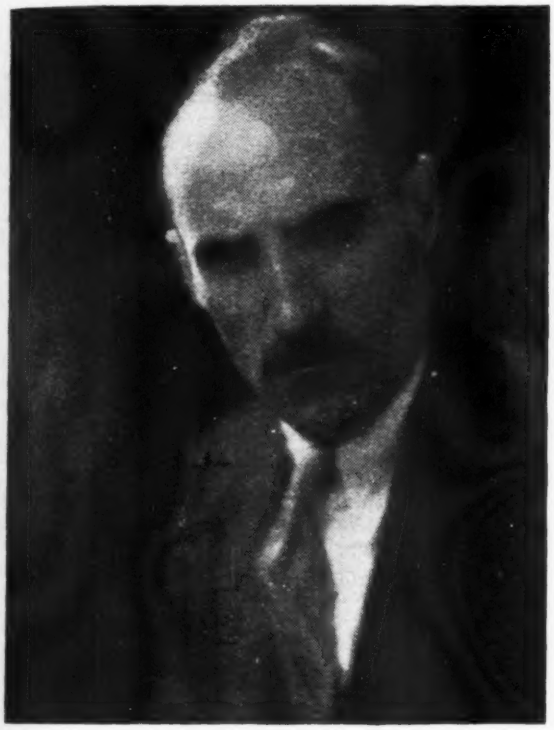
So, with this point in view, through the kind efforts of Mr. C. S. (Casey) Jones, vice-president in charge of Public Relations, the *Curtiss-Wright Corporation,* and Mr. Karl S. Day, assistant to the president of the *Curtiss-Wright Flying Service,* we are enabled to offer you readers of MODEL AIRPLANE NEWS such amazing prizes as:



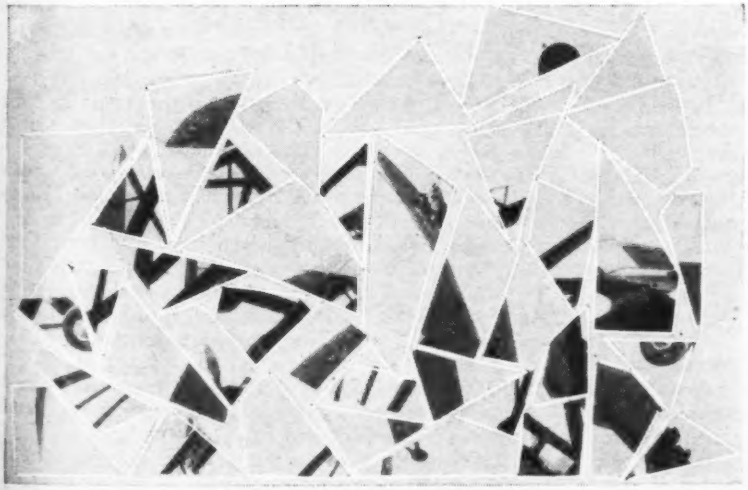
FLYING COURSE!

WHAT YOU WIN!

A 10-hours Flying Course, or to be more exact—sufficient flying time to enable you to sit for a Private Pilot's license—is the *First Prize* in this Monster "Scrambled Picture" Contest. *Second Prize* is a Complete Ground Course; and *Third Prize,* a 200-miles cross-country flight with Mr. C. S. "Casey" Jones as your host-pilot. Three extraordinary great prizes, for some extraordinary simple effort! Start right in, now!



Mr. C. S. (Casey) Jones, famous airman, who will be host-pilot to the winner of the third prize in our monster contest



(A 10 hours Flying Course)—*First Prize*

(This is not exactly right. What we mean really is sufficient dual-control and solo time to enable you to qualify for a private pilot license! Actually much more than just a "Ten-hours Flying Course"!)

(A Complete Ground Course)—*Second Prize*

and

(A 200-miles Cross-Country Flight)—*Third Prize*

AT this juncture, we are going to ask your indulgence about the cover on MODEL AIRPLANE NEWS this month. We promised you last month a great surprise, and the cover is part of it. On the cover you see depicted in actual colors and in Ray Wardel's inimicably detailed style a Curtiss-Wright *Junior* light-airplane.

It is in this type of plane—a Curtiss-Wright *Junior*—that the winner of the first prize will be given his Flying Course.

Then there's the photo of "Casey" Jones himself. That 200 miles cross-country flight is his own personal prize for the contest, and he—"Casey" Jones himself, mark that—will pilot the winner of this third prize on the flight. Can you imagine what that means? A flight of approximately 100 miles to somewhere and back, with "Casey" Jones at the stick? Two hundred miles in the air with one of the world's greatest pilots!

SO you can see that we couldn't help but stretch a point and use our cover to draw your attention to this monster contest. However, Ray Wardel will be back next month with another war-time cover, and as impatient as you might be for that, you'll be just as impatient and more so for further news of the contest, so we none of us lose anything, do we?

The second prize, as you see, is a *Complete Ground Course.* What more could anyone want? As you know, there are virtually twenty ground jobs to every one in the air, and it is from these ground courses that famous design-

ers, engineers, mechanics and so on are developed.

There, in a nutshell is a stepping stone to a career in aviation itself. Honestly, haven't you all just longed for something like this to come along?

However, let's talk about the contest itself.

As we said in the early part of this material, the contest is simple. MODEL AIRPLANE NEWS in three issues—this (September), October, and November —will publish two photographs of two different types of planes, making a total of six planes.

It will be impossible for you to recognize the planes at first glance, however, because they will be "scrambled". That is to say that the photographs will be cut up like a jigsaw puzzle. In the present issue, for instance, the picture might contain parts of a plane, the final parts of which will not be published until next month.

MODEL AIRPLANE NEWS
"SCRAMBLED PICTURE" CONTEST
Entry Form

NAME.. AGE..............
Print your name clearly
Street or P. O. Address..
City.. State..............
Nearest Airport ....
For Parent to Fill in:
I, ..., hereby agree to let my son (daughter), ..., enter the "Scrambled Picture" Contest conducted by MODEL AIRPLANE NEWS. He has read and fully understands the rules.
For your Teacher to Fill in:
This is to certify that .... is sufficiently proficient in his studies to be eligible for the "Scrambled Picture" Contest.
(Signed)..
School..

Mail to:
"Scrambled Picture" Contest,
MODEL AIRPLANE NEWS,
570 Seventh Avenue,
New York City.

Now, your's is the simple job of cutting out those pieces, pasting them together to form the finished picture of the plane, and then identify the plane itself, giving the name and type of engine in the plane, and also stating to what uses the plane is put.

The prizes will be distributed as follows:

To the boy, who, in the opinion of the judges, most neatly and accurately identifies the airplanes and tells to what uses they are put, will be awarded the first prize. Second prize will be awarded to the boy whose work is next best; and the third prize in like manner.

Should two or more competitors tie for any or all prizes, each will be awarded the prize tied for.

THERE are two more things to bear in mind in this contest. They are, NEATNESS and ACCURACY.

Each of the planes pictured are known to you. You see them in the air nearly every day, and you should have no difficulty whatsoever in identifying them, remembering, of course, that just to say "This is a *Condor* passenger plane" is not sufficient identification.

Every plane pictured has an official designation, and those of you who have really studied your planes will know that designation. Those who haven't can easily obtain the information, although we are hoping that every one who enters the contest will fulfill all requirements unaided.

This is not essential to entering the contest, however, and in any case we have not the slightest desire or inclination to check up on you.

Student Permit Needed

Now there is one very important thing to take care of. Naturally every one of you who enters the contest hopes to win. We wish that every one of you could win, and that we could give you all a FREE Flying Course such as outlined. However, that's impossible, of course.

Still, as each and every one of you has an equal chance of winning it is only right that you should be fit in every way to take the flying course, and our only way of knowing this, and the only way in which you will be permitted to take the course, is for you to obtain a STUDENT PERMIT.

To do this you must make application to the Department of Commerce, Aeronautics Branch, Washington, D. C., who will forward you all necessary information. When you write, please mention the MODEL AIRPLANE NEWS contest.

THERE is one point that arises here, and that is in connection with the question of age. It is possible that your age might bar you from obtaining a Student Permit this year, or next year for that matter. Don't let that deter you from entering the contest, though. If it so happens that although you win the contest you are not eligible for the flying course because of your age, we will wait. If you win, the prize is yours, and even if you have to wait a year, surely it is worth waiting for.

Transportation

The winner of the first prize will take his course, at the nearest Curtiss-Wright airport to his home and where Curtiss-Wright *Junior* planes are used for such instruction as necessary for the first prize. Transportation to and from the airport, and living expenses must be borne by the winner of the prizes.

The winner of the second prize will take his course at the nearest Curtiss-Wright Ground School during its regular term. Expenses must be paid as in the case of the first prize.

In the case of the third prize winner—the 200-miles Cross-Country Flight will start from the nearest *Curtiss-Wright Flying Service* airport, or some other airport convenient to Mr. Jones. The flight itself will also take place at Mr. Jones' convenience.

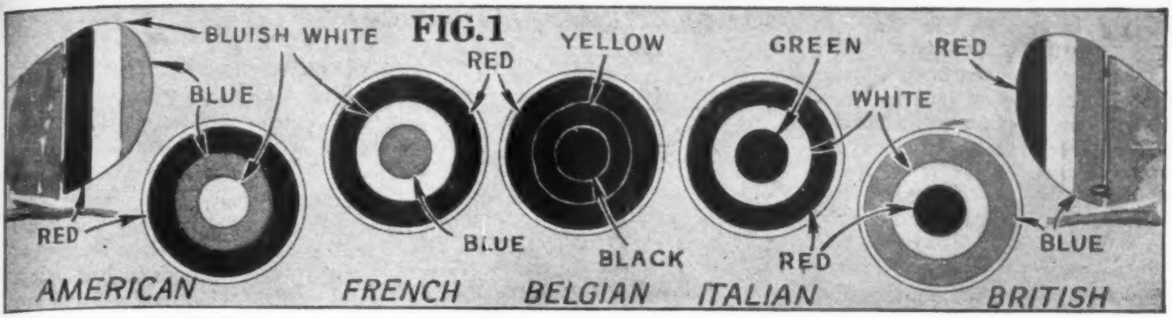
If there is no airport in your town and you should be the lucky winner of this 200-miles flight, then you will have to pay your own transportation to the airport.

While on this subject of prize winning, we want to draw your attention to the rule which states that "No correspondence will be entered into." This rule is rigid. We'll have enough work deciding which are the winners. Everything concerning the contest is outlined in these columns. The winners will be notified by letter and through MODEL AIRPLANE NEWS, so that there will be no need to write and ask "Did I win a prize," or other questions.

THE entry blank is your official entry form in the contest and no letter need accompany it. Be careful to PRINT your name and full postal address.

That seems to be all for the moment, so let's just repeat a few pointers to further impress them on your mind.

Remember that NEATNESS (*Continued on page* 43)



The above insignia were reproduced from an actual-color drawing so that you may see how certain colors appear when photographed.

All About War Camouflage

Our Cover Artist Shows You How and Why Battle Planes Were Disguised With Color

By Ray C. Wardel

CAMOUFLAGE is widely misunderstood. I have even had a magazine editor who deals in flying war stories tell me that it was not used on airplanes. A few hints on the sound reason behind camouflage will help you to color your war models correctly.

Early in the war the authorities and experts were glad to have planes that flew, and military authorities scorned the artist as a helper. They wanted just plain airplane color.

Camouflage did not count for much up to about 1916 and 1917. Even in our own A.E.F., I know of an artillery commander who ordered bulky rolls of camouflage—which had been painfully dragged up to the lines to hide his men, guns and ammunition—to be heaved into shell holes in the road to cut out detours.

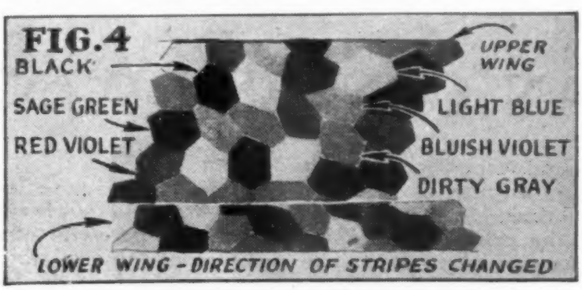
However, there was a merry orgy of hand decoration on planes in 1917 and the early part of 1918, so most anything you do to a model of that period would look O.K., if you follow the hints given here in general form. These artistic efforts were perpetrated according to the ideas of flight commanders, pilots or the enlisted men who did the daubing. Our own paint came in discarded and revamped "Corn Willy" cans from Camouflage Headquarters at Dijon.

The first idea was to attempt to hide the plane by making it blend with the landscape by painting green, brown and yellow and sometimes mauve on all top surfaces, and to blend with the sky by painting blue on under surfaces. The success depended largely on light conditions of the moment.

There are no straight lines in nature—its irregular contours make distinct contrast with the hard straight edges of man-made contraptions.

Clearly Fig. 3 would enable a plane to slip along over the countryside and be very hard to see from above. But suppose an enemy got close enough to sight his guns. What price Camouflage? Hah! there's the trick.

You're whirling; your eyes glued to the sights—you have a fraction of a second and no ammunition to waste—a dark mass flits across the sights and you're sure you got him with that short burst right in the head. But it was only a dark reddish gob of camouflage on his tail assembly you peppered!!



This photo shows the exact colors (and how they reproduce) used on a German A. E. G. Bomber

LIKE marine camouflage, the flying variety was mainly to confuse the gunner. The Germans developed a type of colored pattern composed of 18" hexagons which was exceptionally protective since it satisfied both essentials of confusion and concealment.

Note how Fig. 4 pattern, viewed from a mile or so, would break the plane up into cross stripes much like light and shade streaks on the ground. To a bomber concealment from fast scout patrols was very important. Yet on close inspection the stripes lost significance and picked out into individual dazzling colored spots.

Towards the close of the war camouflage was included in the specifications and the manufacturers put on certain set designs before the fabric was stretched.

In coloring your models consider first the purpose of the plane. A night flyer should be colored in night colors. Take a color reproduction of a moonlight or night scene by a good colorist like Walter Biggs and gray your colors to match his tones.

Colors should seldom be used on camouflage in pure state. O. D. (olive drab) was commonly used on top sides, also battleship gray. Green should have a little red and white; red should be killed with green or blue. Blue may

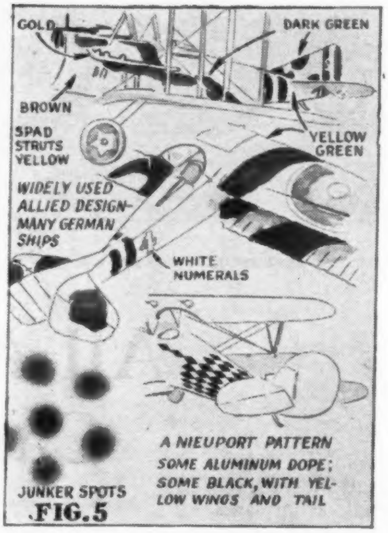
be used pure, lightened with white. Peacock or turquoise blue was used considerably, especially in shadow places and under sides as it looks like atmosphere. It photographs almost white.

Of course the predominating paint for shadow sides, especially on English planes was aluminum, or aluminum dope.

Even the season was considered. Reds, oranges and yellow were good in the fall and snow tones blended better in the winter.

Blue on upper sides should run toward the blue-violet or reddish mauve. Take any good colored birds-eye view and imitate the shadow colors thereon and you will have correct color for your dark spots.

Light surfaces in sunlight are represented by an artist in very light yellow and pink. Pink fades too easily so the light patterns are usually toward yellow ochre, which is a good durable pigment, with white, of course. Bright yellow would be fine on a sunny day but it would stick out of a cloud or fog, so light spots should be more of an average. Judged by my own experience of "Sunny France" in 1918 blue would be a very proper all-around color.



Here the artist shows you a few designs adopted by the camouflage sections of the various beligerents during the war

violent red and green designs.

Many German ships were black and white or with large areas of blue-black (which photographs quite dark); wings, fins and tail white; struts and chassis black. The Fokker D7 often had dark green wings and tail with orange fuselage and struts. The Albatros sometimes had orange wings; light blue fuselage and tail, and the L.V.G. CII sometimes green and mauve with spotted background.

Another German color scheme was to start with a dark color forward and let it fade gradually to a light purple at the tail. Sometimes camouflage spots were spattered over with a lighter tone by scraping a stick across a brushful of paint.

Planes used by Americans early in 1918 sometimes show French or English insignia. Not having planes of their own our flyers had to start with ships built and painted for our Allies: hence the confusion.

The old Russian insignia was adopted by our War Department in January, 1918, and orders issued to paint our ships accordingly (see Fig. 1). Cocades on sides of fuselages were common only in the R.F.C.

Showing how camouflage breaks the line and makes the plane indistinguishable. The wing (right) without camouflage is easily picked off, while (left) it can hardly be seen

BEAR in mind that magazine covers are painted to attract the eye and convey some impression of beauty even to a war subject, whereas your models to be true should run to more somber and grayed tones. Of course Richthofen's circus did have some red and black and red and white checkerboard designs and there were scouts with

German ships usually had crosses there and their later scouts had four crosses there; top, bottom and both sides. They also had a cross on the nose under the prop on many machines. There was a practice of painting a band of color around the nose of American planes as a squadron identification.

Put Maltese crosses on German ships up to April 25, 1918, and straight sided crosses after that date.

EXTRA! EXTRA!

SLOGAN CONTEST WINNERS!

Well, that's over—and what a job it was, too!

If you think wading through more than 3,000 slogans, to choose four prize winners isn't a task, just try it some time. And the hard part of it was that they were all so good. It really was difficult deciding the prize winning slogans, and we herewith offer our congratulations to you all, and wish we had space enough to print many others, which deserved honorary mention.

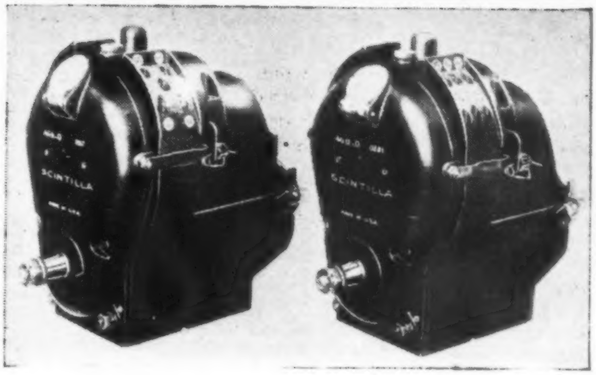
However, here are the lucky winners:

FIRST PRIZE	SECOND PRIZE	THIRD PRIZE	FOURTH PRIZE
"Take a Course in Aviation for 15c a Month."	*"A Non-stop Flight to Efficient Aeronautics."*	*"For the Students of Today—the Experts of Tomorrow.*	*"For Today's Model Builders, and Tomorrow's Pilots."*
By	By	By	By
VANDERBILT SPADER, Peacham, Vermont	ROBERT E. DEPPE, 401 Main Street, West Catasauqua, Pa.	I. LEE HANKEY, 49½ E. Franklin Street, Hagerstown, Md.	JASPER B. SINCLAIR, 318, 20th Avenue, San Francisco, Calif.

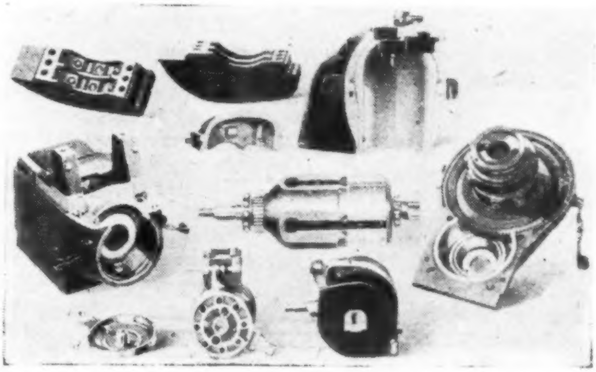
The Airplane Engine

(CHAPTER 4)

The Ignition System



By Lt. H. B. Miller, U. S. Navy



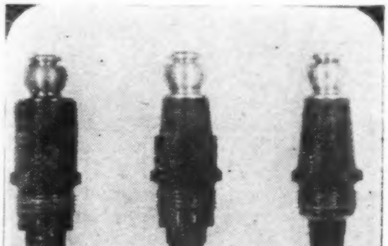
Our photographs show (above) the Scintilla Magneto fully assembled, and (at left) the various parts which comprise this valuable unit of the ignition system

IT is now a generally accepted fact that if power plants had been available to various experimenters, flight with a man-made machine would have taken place many years earlier than 1903. Perhaps the honor would have fallen to Stringfellow, an Englishman, who in 1848 actually flew a 10-foot span model powered with a steam engine.

It could have been said at that time that the person who would fly must first be an excellent engine designer. This proved to be so. Professor Langley was fortunate in having the help of Charles Manley who designed and built his five-cylinder radial engine so splendidly that its power-weight ratio was not again reached for nearly twenty years. Nor was it the fault of this fine engine that Langley's machine was not the first to carry a human in flight.

The Wrights imported an engine from Europe for use in their memorable flight only to discard it as useless. In the end they had to build their own powerplant. Since then airplane engines have made steady progress, due to the impetus of the World War and the increasingly important commercial developments in aviation.

As a chain is no stronger than its weakest link, the airplane engine is no more reliable than its many component systems, such as lubrication, carburetion, cooling and ignition. Fortunately, the various parts which enter into the reliability of the engine have received considerable attention. Particularly has ignition kept pace with engineering developments and today it is seldom that this part of the engine forces a pilot to land. It is to be assumed, of course, that a reasonable amount of intelligent care is spent on the system.



How a sparkplug is made

Attempts were made to design an internal combustion engine long before electricity had reached a point of usefulness. The earliest type of ignition used was the open flame. A sliding port opened at the proper moment of ignition and the gases were set off by coming into contact with a flame maintained by a jet of acetylene gas. Naturally, as compression was introduced the fuel gases rushed into the chamber too quickly and extinguished the flame. This method thus became impractical.

The flame was next enclosed in a platinum tube which was maintained at a state of incandescence. Although the flames could not be extinguished, the operator had no control of his point of ignition and, on the whole, this method was never entirely satisfactory.

The situation improved considerably, however, upon the advent of a working knowledge of electricity, and it was put to immediate use. At the beginning a low tension system was used as extremely high voltages were unknown. An arc was created within the cylinder by sliding two electrodes across each other, thus forming a smear or arc. This type of ignition was known as the "make and break". It was used for some time on automobiles and is still used occasionally on slow marine engines.

It has never been used on airplane engines, fortunately. The increased number of moving parts within the cylinder tends towards unreliability. The electrodes burn off quickly and another outlet must be made in the cylinder head for the sliding electrode.

AT first, storage batteries were used as the source of electrical energy but these were later replaced by generators which were geared to the engine.

The latest and best type of ignition developed for modern engines is the high tension system and is the one

in general use today. It uses as high as 15,000 volts. The electrical energy for this ignition may come from a battery, but these are heavy, cumbersome, and would have to be recharged at frequent intervals.

Some systems, such as the Delco which was used on the Liberty engine, used a battery for starting the engine. When up to speed a generator furnished the electrical power which not only sent the voltage to the spark plugs but recharged the battery. The latter system is in use today on planes that require electricity for running lights, starters, radio, lighted cabins, and the like. In a case of this sort, the total weight of the system is somewhat less.

Magneto ignition, however, is in general use by practically all airplane engines. The magneto is a simple, compact machine which serves a variety of purposes. First, it generates an electric motive force of sufficiently high voltage to arc in the modern high-compression cylinder. Secondly, it distributes the high voltage to the proper cylinder at the correct point of the engine cycle. In addition, provision is made to allow the pilot to change this ignition point; that is, he can retard or advance the spark at will.

Two other units are essential to the ignition system. Means must be provided to convey the voltage to the cylinder and a reliable sparking device must be available within the combustion chamber to permit an electric arc which will result in the successful ignition of the explosive charge. (See illustration).

IN order to gain reliability two distinctly separate ignition systems are mounted on all airplane engines. Two spark plugs are inserted in each cylinder, each of which is controlled by separate magnetoes. Generally, the magneto on the right side of the engine fires the forward plugs of a radial engine, while the rear plugs are fired by the left magneto.

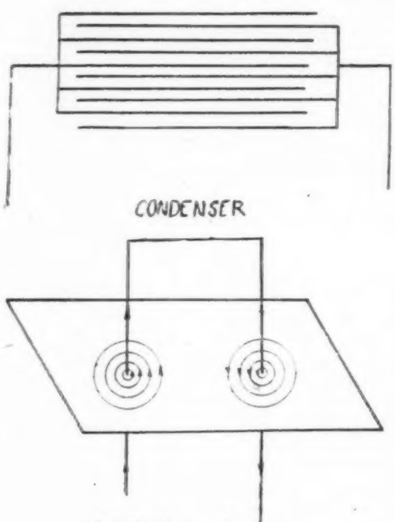
The engine will operate on either magneto. This is controlled by the pilot with his ignition switch. The common practice is to operate the engine with both magnetoes firing simultaneously. In addition to reliability, power is gained by the use of two sparks per cylinder. Since the fuel charge is ignited in two spots it will burn quicker. This smaller time of combustion will generate increased pressure on the piston tops. Consequently, the engine will turn up from fifty to one hundred more revolutions.

Since the generation of electricity is dependent on magnetism, the study of the magneto must necessarily include the phenomena of the magnet. All of us have used the familiar horseshoe magnet to attract metal particles or small pieces of iron. It was observed that only the extreme ends of the magnet gathered up the filings. If the magnet were straightened out into a bar, again only the ends would attract the iron particles. It would be only a fair supposition to believe that some particular force was acting on the ends of the magnets.

IF a sheet of paper is placed over the length of a magnet and iron filings are scattered lightly on it, the small particles will be found to form themselves into a very definite pattern. On the other hand, if a finely balanced iron needle is moved from end to end of a magnet, the needle will be found to trace a curved path which leaves one end of the magnet and curves symmetrically to the other end. (See Fig. 1.)

In other words, some very definite invisible force is passing between the two ends or poles of the magnet. The end from which the lines of magnetic force emerge is called the North Pole while the end which receives the lines of force is termed the South Pole. It is to be noted that a magnet is thus a distinct source of energy.

No one is certain just what electricity is, nor, for that matter, just what the lines of force of a magnet are. Nevertheless, the phenomena exists and some very definite relations between the two have been established. It is known, for instance, that if we have magnetism, we can obtain electricity and vice versa.

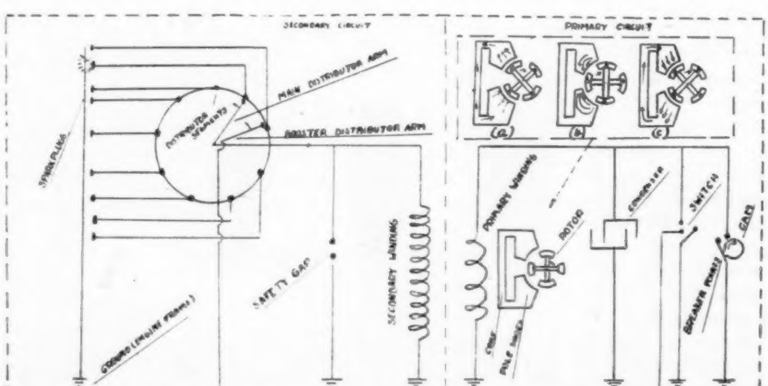

CONDENSER

RIGHT-HAND RULE

An electrical charge in motion is called an electric current. Its presence can easily be determined by the magnetic effect it produces. Lines of force similar to those of the magnet pass around a conductor that contains a current of electricity.

If we explore the area surrounding the conductor, we find the magnetic lines of force existing in the form of concentric circles. The strength of this magnetic field will depend directly on the strength of the passing current. Moreover, the circling lines of force lie in a plane perpendicular to the path of the current.

The direction of the lines of force is determined by Ampere's Rule, more commonly known as the Right Hand Rule. It states that, "If the right hand grasps the wire as shown in Fig. 2, so that the thumb points in the direction in which the current is flowing, then the magnetic lines encircle the wire in the same direction as the fingers of the hand." Naturally, if the current should change its direction of flow, the lines of force would reverse their direction.

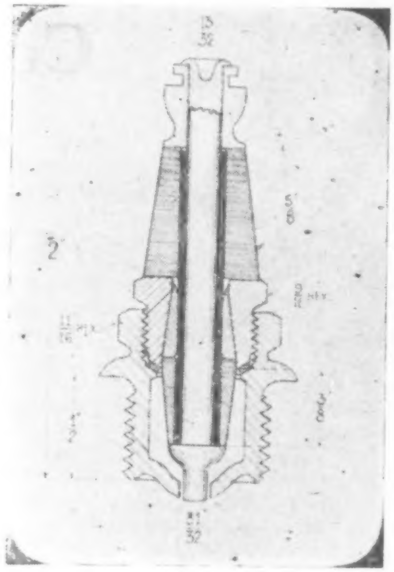


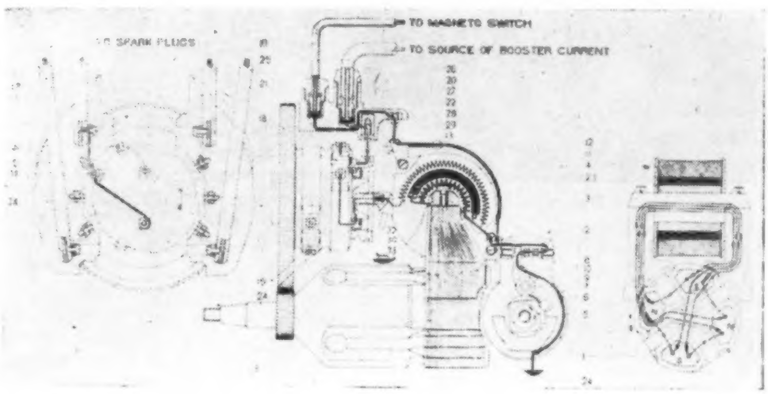
Since lines of force result from a flow of electricity, if similar lines of force can be forced around a dead conductor, it follows that a current of electricity will be built up within that conductor

providing the circuit is completed. It makes no difference whether the lines of force originate within a magnet or around another conductor carrying a current of electricity.

If we pass a conductor between the poles of a magnet and complete the circuit, an electric motive force will be induced within that conductor. This will result in a moving current. This force will be induced as long as there is relative motion between the lines of force and the conductor.

In Fig. 3, movement of either the conductor or the magnet may take place. The only requirement is that the lines of force actually be cut by the conductor. As the conductor begins to move through the lines of force, they resist because of their strength. Rubber-like, however, they give way and as they are at last cut, they tend to wrap themselves around the conductor. This is the condition we desire in order to induce an electric motive force within the conductor.





The more lines cut per second, the higher the induced voltage. It requires the cutting of 100,000,000 lines of force per second to induce an electric motive force of one volt. Basically, this is how all electricity is generated with the exception of batteries. The powerhouse around the corner does exactly this same thing. So does the magneto.

IT is mechanically difficult to actually cut the lines of force by moving the conductor. A simpler way would be to have the lines of force move and thus permit the conductors to remain stationary. This can be done by using an alternating current to develop the lines of force. Remember that according to the Right Hand Rule the direction of the lines of force depend on the direction of the passing current. As the current alternates rapidly the magnetic field is built up first one way then is collapsed as the current dies out. As the current then passes in the opposite direction, the field also builds up to a maximum in the opposite direction.

If, then, a conductor is placed in a position so that the rapidly building up and collapsing of the lines of force cut it, an electric motive force will be induced therein. Upon this principle is built the magneto.

The simplest form of a magneto is one with a rotating magnet. This type will be explained. The magnet has four poles, two North and two South. It is rotated by means of direct gearing to the engine crankshaft. The magnet rotates inside a magneto housing in which are mounted two pole shoes which extend up through the casing. Across the upper extremities of these shoes is fitted a soft iron core around which are wrapped both the primary and the secondary coil.

By glancing at Fig. 4 (a) it is seen that the magnetic lines of force or flux jump from the North pole to the pole shoe, thence through the core, the other pole shoe, and back to the South pole. The circuit is completed through the length of the magnet. In Fig. 4 (c) the magnet has been rotated to a new position and the direction of the flux has been reversed.

CONSEQUENTLY as the flux continues to alternate, it is cutting the copper wire in the primary coil and inducing in the primary circuit an electromotive force of about thirteen volts and 2.5 amperes. Obviously, this primary current is also alternating. Note that the primary current can be induced only when the primary circuit is complete. That is, of course, when BP, the breaker points, are closed.

When it is considered that it requires a voltage of approximately 6,000 to jump across the sparkplug gap which is under high compression, it is easily seen that we must build up our primary electromotive force to a much higher value. Of course, as the primary current alternates, its magnetic field actually cuts the secondary coil and induces a certain electromotive force therein. However, the alternations are very slow relatively and the induced secondary voltage is insufficient to break down the sparkplug gap.

It becomes necessary to break down the primary field at a faster rate. This can be done by inserting the breaker points in the circuit. When the primary current is at a maximum, the points are opened by a timed cam which is secured to the rotating magnet. As the field breaks down it cuts the 165 turns of its creator, the primary coil. This induces a temporary self-induced voltage of approximately 150 volts in the primary circuit.

Ordinarily we could expect this temporary strong voltage to jump across the breaker points. If it did this, we would not only burn the platinum points to a state of uselessness, but the primary circuit would again be completed by the resulting arc and this would prevent the necessary rapid breakdown of the lines of force around the coil.

A CONDENSER, Fig. 5 is placed across the primary circuit. It consists of planes of conductors well insulated from each other. Alternate conductors are led to each side of the circuit. A condenser has the ability to absorb a certain amount of voltage though it will not retain it. Thus, when the self-induced voltage rushes back from the primary coil, it finds it easier to enter the condenser than to attempt to jump the breaker point gap.

As we have said, however, the condenser gives the charge a rubber ball action. It bounces (*Continued on page* 41)

Collishaw seated in his Sopwith *Camel*

Collishaw of Canada

A Brief Sketch of the Most Unheralded Hero of the World War

By L. Elsen

THE illustrious names of von Richthofen, Guynemer, Fonck, Boelke, Immelmann and others, are familiar to all who thrill to the exploits of the aerial fighters in the Great War—but, surprisingly enough, little is known generally of a man who at the end of the war held the brilliant record of having destroyed seventy-seven enemy planes — a record exceeded among the Allied aviators by Rene Fonck alone, and following closely on the heels of von Richthofen's achievements.

The traditional reticence of Great Britain is responsible. Reluctant as the Air Ministry was to enlarge on the exploits of the Royal Flying Corps, it was even more reserved about the members of the Royal Naval Air Service. (These two branches of the aerial service were merged on April 1, 1918, to form the present Royal Air Force.)

So with no fanfare of drums Raymond Collishaw, C.B.E., D.S.O. and Bar, D.S.C., D.F.C., Croix de Guerre, emerged unscathed from the World War to carry on. He chose to remain with the British air service and it led him to wage war against the Bolshevists in Russia, then to Persia and Mesopotamia, and to fight the Arabs in Palestine in 1929.

His story reads like a tale by Dumas. Seemingly impossible adventures pile up as one delves into his past. Unlike so many figures who plunged from placid obscurity into the maelstrom of war to achieve fame, Raymond Collishaw at the age of twenty already had been to the Antarctic with a polar expedition and had sailed as second officer on the Alaska run from Victoria in the historic era when the Yukon was attracting hordes of seekers after its golden treasures.

Thus one can safely assume that the Canadian Collishaw is today the most experienced aerial fighter in the world—and, ironically enough, the most unheralded and unsung hero of the Great War.

Nanaimo, British Columbia, is a seaport where ships anchor and depart—so it is not surprising to learn that Raymond Collishaw, who was born there on November 22, 1893, took to the sea and navigation from boyhood. The merchant marine attracted him at an early age and introduced him to the Alaskan territories. Then the ill-fated Scott Antarctic Expedition required the services of an officer well-versed in navigation, and Collishaw joined them.

After a long stay in the Southern wastes, during which Scott and the advance party moved to the South Pole, only to die on the way back to the camp where the others, among whom was Collishaw, waited, the young Canadian returned safely to British Columbia.

Then came the World War. It found Collishaw again plying the waters of the Pacific Coast and brought him to England to volunteer for naval duty. There, however, he was drawn to aviation and at the end of 1915 he was accepted in the R.N.A.C. He qualified as a pilot in January 1916 and was assigned to patrolling the coast along the English Channel for enemy submarines. It was a ceaseless vigil with little opportunity to distinguish oneself in individual encounters, and the young adventurer marked time until he should actually meet the enemy.

On being transferred to the Third Wing, R.N.A.S., in France on August 2, 1916 the chance to fight came and he was jubilant. Ochey was the locale of his airdrome, quite a distance behind the French trenches, and their work consisted principally of long-range bombing. Giant bombing machines would leave each day to penetrate deep into enemy territory and Collishaw with other scout pilots would accompany them.

THE Canadian's first actual encounter with the enemy in the air took place on October 12, 1916, almost 140 miles from the front and resulted in his victory over a Fokker. Two weeks later he set out in a new two-seater machine and was suddenly attacked by six German scouts above him. His only chance was to dive towards the ground and "contour chase" for a bit.

The twin Spandaus of the enemy rained a hail of bullets down after him as the mad chase began. As soon as Collishaw saw that his pursuers had lost their advantage of height, he turned quickly to attack. One German plane went crashing down, then *(Continued on page 42)*

Complete Course in Aerial Radio

A Cardinal Point in Progressive Aviation

(*CHAPTER 4*)

By Capt. Leslie S. Potter

An Armstrong-Whitworth *Atlas*, British, equipped with a "Jaguar" engine, picking up a message bag during contact patrol maneuvers.

IN the preceding articles we have described briefly the principles of radio waves, magnetism, electricity, what it is and how it is generated, and the more important devices connected with its production. We will now proceed with its application in the transmission of radio waves.

The Buzzer

Everyone knows the instrument familiarly described as the buzzer, and those who are taking up radio telegraphy seriously will have to acquire a thorough knowledge of it and proficiency in its use before they will be able to pass the sending tests.

So before we proceed further with the principles of radio transmission we will describe in detail the functions and construction of a buzzer so that the reader may, if he likes, make one for himself and employ his time, till the appearance of next month's MODEL AIRPLANE NEWS, in practicing sending. A complete table of signals used is given at the end of this article.

Figure 1 shows a conventional type of telegraph key. A simple type has been shown in order that its mode of operation may be explained easily. The two screws at the top are adjusting screws for adjusting the gap between the points, and these may be operated so as either to increase or decrease the gap.

Different operators will prefer different adjustments. This is, of course, a matter for individual choice, but a minimum gap facilitates the speed in sending. With a correctly adjusted instrument, an experienced operator can send twenty-five words a minute, (125 letters), continental code, without difficulty for long periods.

The function of the spring in the center to force the key upwards on release is obvious. The contact points at the end are made of silver, and the key in general is much the same as those used for ordinary telegraph purposes. The radio key usually will be more soundly constructed and provided with heavier contact points to deal with the greater currents employed.

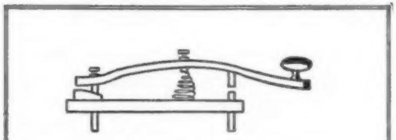


FIG 1 · TRANSMITTING KEY

Figure 2 shows the electro-magnets. These are composed of two soft iron cores inserted in two solenoids—two coils of wire through which a current is passing. The solenoids have been wound oppositely so as to create opposite polarity. When a current passes through the coils, a magnetism is set up in the soft iron cores which lasts as long as the current flows.

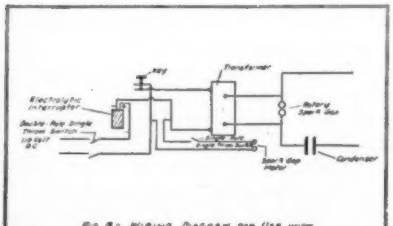


FIG. 3 - WIRING DIAGRAM FOR USE WITH ELECTROLYTIC INTERRUPTER

In Figure 3 we have the magnets and vibrator assembled. The pressing of the key causes a current to flow round the coils. The cores inside become magnetized and attract the vibrator. As soon as the vibrator is drawn away from the adjusting screw, the circuit is broken and the current ceases.

The cessation of the current causes the cores to lose their magnetism, and the vibrator flies back to the screw by its own tension and once more completes the circuit. The cycle of operations is then repeated. By adjusting the gap between the vibrator and the coils the pitch of the tone may be varied.

Such a set as this is essential to the student who intends to practice at home. The whole set may be purchased complete for about $2.50, or the parts may be bought separately and assembled later by the student. A slight saving will probably be effected by the latter method.

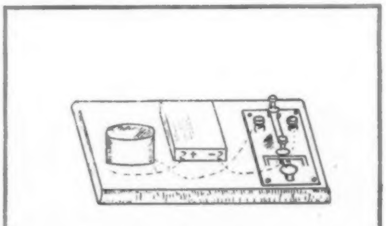


FIG. 5 - BUZZER SET

In Figure 5 the complete set is shown assembled. As will be seen,

one of the key terminals is connected to the battery and the other to the coils. A further connection is made between the remaining battery and coil terminals. Almost any type of dry cell battery will serve for use with a buzzer. The 4½-volt Eveready C battery is one that will give long and economical service.

TO enthusiasts who get their sets ready and start practicing, the following information will be useful. A first class operator must pass code tests in transmission and reception at a speed of at least twenty words per minute continental code, in code groups, and twenty-five words per minute in plain language, five characters to the word. 75% is the passing mark.

For a second class license the speed is reduced to sixteen words per minute in code groups, and twenty words per minute in plain language; 65% constitutes the passing mark in this class.

How the Transmitting Set Works

With the transmitting key appropriately connected to an antenna, the pressing of the key completes the circuit with which it is connected, and thus opens a path for the flow of electricity to the antenna, from whence the electro-magnetic waves are radiated.

With the key pressed for a short time only, a momentary flow of electricity passes through the contact points and the electro-magnetic waves radiated from the antenna are of short duration. The sound then heard in receiving telephones is called a dot. When the key is pressed down for a longer period, a longer sound is heard which is called a dash.

Before continuing this discussion of radio transmission the reader is reminded that a government license is necessary before even an amateur sending station can be set up. There are various conditions and requirements attached to this license. The radio supervisor of the district in which you live will supply you with all the necessary information on request. Don't start erecting a set without permission; the government simply doesn't like it.

Electro-magnetic waves are only useful for radio purposes when the antenna from which they are emitted is energized by a high frequency current; otherwise they have practically no radiation. Furthermore, they must be forced on to the antenna at high pressures. Other things being equal, a sending station working on the highest frequency and using the greatest power will give the sharpest signals and have the longest radius.

Spark Coil Set

THESE sets are being used less and less owing to the great interference caused by the strongly damped waves they send out, and government restrictions require that the use of certain spark gaps shall cease entirely by a certain date.

The principles of the vibrator have already been explained. In this set the two coils in conjunction with which the vibrator operates are slightly different from those used with the buzzer outfit. To all intents and purposes they perform the functions of a transformer.

The primary coil has a small number of turns of thick insulated copper wire, while the secondary coil will have an immense number of turns of very much finer insulated copper wire. The proportion of turns between one and the other is called the ratio of transformation. This was explained in an earlier article.

As soon as the key is depressed and a current flows into the primary coil, a magnetism is set up. The lines of magnetic force proceeding from this magnetism cut the secondary coil and set up in it an electric current in one direction. The attraction of the vibrator then causes the circuit to be broken and the current to cease. The magnetic lines of force which have been emanating from the primary coil contract and return, and in so doing again cut the secondary coil and again set up a momentary current in it, but this time in a reverse direction because the lines of force are cutting from an opposite angle. This operation happens many times a second.

Thus the low voltage direct current from the battery is changed into an alternating current, the frequency of which is regulated by the vibrator. Furthermore, this low voltage current is stepped up enormously by the ratio of transformation between the two coils. The current is next passed on to the spark gap; see Figure 6.

FIG. 4 - DRY CELL

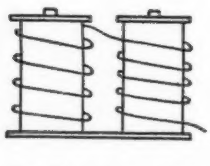


FIG. 2 - ELECTRO-MAGNETS FOR USE WITH BUZZER

When it reaches the balls, or electrodes, one of these becomes charged negatively and the other positively. Remembering what we said in an earlier article about difference of potential and the tendency of electrons to preserve an equilibrium, it will be seen that it only requires the difference of potential to become sufficiently high in relation to the distance of the spark gap, before a spark will jump this gap and an electric current will surge back and forth with great frequency.

IF a ground wire and an aerial are connected to the electrodes, these oscillations will surge up and down it and their energies provide the impulses known as radio waves. The crackling noise that is heard when a current is jumping a spark gap is caused by the air that rushes in to take the place of air that has been burnt out.

Current used in the operation of a transmitting set may be of two kinds; direct or alternating. Some amateur transmitting sets feed city power into the transformer and this is usually 110 volt direct current. In cases where 110 volt direct current is used, a device called an Electrolytic Interrupter becomes necessary to perform the same functions of making and breaking the circuit that were performed by the vibrator in the spark coil set.

Figure 7 shows a type of electrolytic interrupter. As will be seen, it consists of a glass jar containing a solution of sulphuric acid into which have been immersed two electrodes. One is of lead, and the other, shaped like a pencil, is made of platinum or of an alloy containing a high percentage of platinum. The portion of it immersed in the solution is, except at its lower extremity, completely covered with a glass or porcelain tube which protects it from the action of the acid. The point at the bottom remains exposed.

As the current passes through the solution, bubbles of oxygen are caused and these accumulate round the platinum point until they have completely insulated it from the solution. When this occurs the circuit is broken and the cur-

rent ceases to flow. The bubbles thereupon settle back again into the solution, the platinum point is once more exposed, the current flows again and the cycle of operations is repeated.

This type of interrupter works accurately over long periods and requires little attention beyond seeing that the solution is maintained at its proper level. Its speed will depend on the size of the platinum point and the voltage of the current passing through it. Figure 8 shows a wiring diagram for use in connection with an electrolytic interrupter.

WHEN an alternating current is used, no vibrator or interrupter is needed, though the power transformer still remains necessary. The step-up transformer used in radio is usually called a power transformer. The current ebbs and flows into the primary coil, the core of this coil becomes magnetized, and the lines of magnetic force which emanate from it ebb and flow with the same regularity as the current. This sets up an alternating current in the secondary coil of exactly the same frequency, though, of course, of a much higher voltage. Other types of transmitting sets will be described in later articles.

Wave Length

In the early days of radio there was much confusion caused by the indiscriminate use of wave lengths. It was impossible to tune in to a station with any degree of clarity owing to the interference caused by other operators using the same wave length. Today, these problems have all been settled by regulations and laws made at different international conventions, and agreement has been reached between the different nations regarding the use of various wave lengths. There is only one call that an operator may use on a wave length that will interfere with everybody. It is the S.O.S. call.

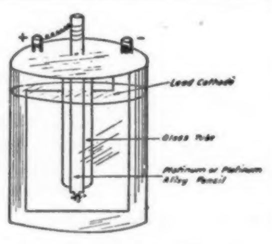


FIG. 7 · ELECTROLYTIC INTERRUPTER

Wave length is regulated by the frequency and may be found by dividing the frequency into the velocity of the waves. It has already been stated that electromagnetic waves travel with the velocity of light and that this is 3×10^8 metres, or 300,000,000 metres per second. In these formulae the Greek letter lambda, λ, is used to indicate wave length. If the frequency were 150,000 the λm. (wave length in metres) would be

$$\frac{300,000,000}{150,000} = 2,000 \text{ metres.}$$

By the same formula, if the velocity is divided by the wave length, the result will be the frequency in cycles. Taking the same figures we have:

$$\frac{300,000,000}{2,000} = 150,000 \text{ cycles or } 150 \text{ kilocycles}$$

A kilocycle is a thousand cycles. A simple method of converting wave length into kilocycles is to divide the former into 300,000 to get the latter. Inversely, by dividing the frequency in kilocycles into 300,000 we have the wave length in metres.

From the fact that the maintenance of a correct wave length depends on the maintenance of a correct frequency, it will be seen how essential it is that this should be kept as constant as possible. It is for this reason that the shunt motor, described in an earlier article, is generally used in radio work owing to its ability to maintain more or less constant speeds under changing loads.

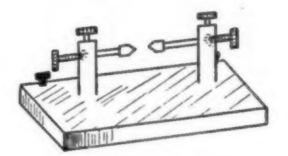


FIG. 6 PLAIN STRAIGHT SPARK GAP

Codes

The best way of learning the various codes is by writing down the signals and learning them by sight, and then practicing them on a sending key and learning them by sound. In some schools the practice of learning the signals by their opposites is adopted. For instance, the opposite of A is N and of G is W, but this method often causes more confusion that help.

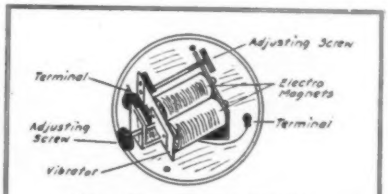


FIG. 3 MAGNETS AND VIBRATOR

In a school with which I was connected students used to memorize certain signals by catch phrases suggested by their rhythm. For example, F (· · — ·) was often recalled by the phrase "Did it hurt you," Q, (— — · —) became similarly, "God save the King" and there were many others. More of these may suggest themselves to the reader, and if found helpful, should be adopted.

Owing to lack of space, only the more important abbreviations have been included. If a sufficient demand occurs for all of these, arrangements will be made to include them all in a later article.

International Morse Code and Conventional Signals

to be used for all general public service radio communications.

A · —	Period	· · · · · ·	1 · — — — —
B — · · ·	Semicolon	— · — · — ·	2 · · — — —
C — · — ·	Colon	— — — · · ·	3 · · · — —
D — · ·	Comma	· — · — · —	4 · · · · —
E ·	Interrogation	· · — — · ·	5 · · · · ·
F · · — ·	Exclamation point	— — · · — —	6 — · · · ·
G — — ·	Apostrophe	· — — — — ·	7 — — · · ·
H · · · ·	Hyphen	— · · · · —	8 — — — · ·
I · ·	Parenthesis	— · — — · —	9 — — — — ·
J · — — —	Inverted commas	· — · · — ·	0 — — — — —
K — · —	Underline	· · — — · —	
L · — · ·	Double dash	— · · · —	
M — —	Distress call	· · · — — — · · ·	

N — ·
Attention call to precede every transmission — · — · —
O — — —
General enquiry call — · — · — — · —
P · — — ·
From (de) — · · ·
Q — — · —
Invitation to transmit (go ahead) — · —
R · — ·
Warning—high power — — · · — —
S · · ·
Question (please repeat after interrupting long messages) · · — — · ·
T —
U · · —
Wait · — · · ·
V · · · —
Break (Bk.) (double dash) — · · · —
W · — —
Understand · · · — ·
X — · · —
Error · · · · · · · ·
Y — · — —
Z — — · ·
Received (O.K.) · — ·

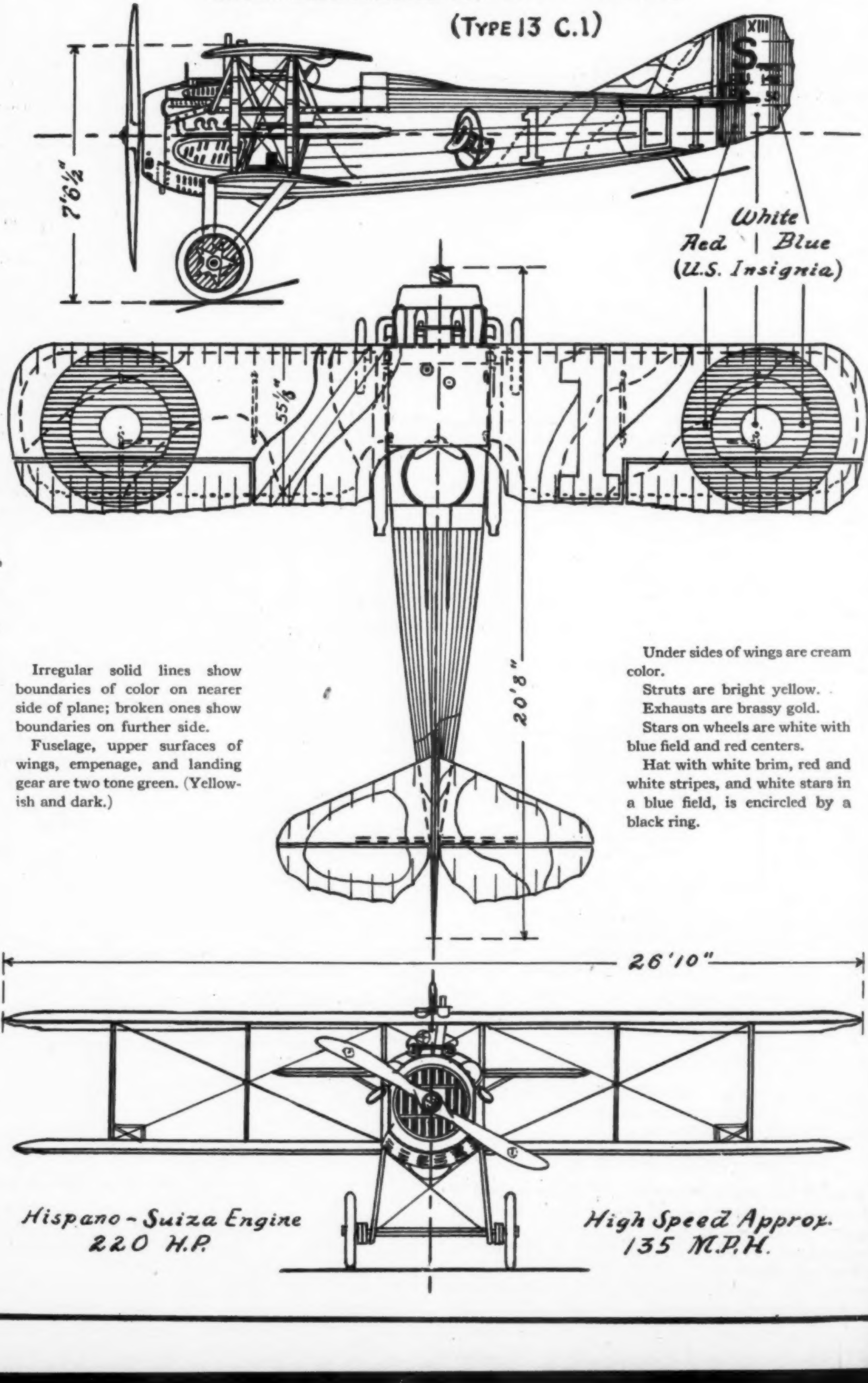
Ä (German) · — · —
A (Spanish) · — — · —
CH (German Spanish) — — — —
E (French) · · — · ·
N (Spanish) — — · — —
Ö (German) — — — ·
Ü (German) · · — —

Position report (to precede all position messages) — · — ·
End of each message (cross) · — · — ·
Transmission finished (end of work) (correspondence finished) · · · — · —

(Editor's Note: The other abbreviations appear on page 48.)

COL. RICKENBACKER'S SPAD

(TYPE 13 C.1)



Irregular solid lines show boundaries of color on nearer side of plane; broken ones show boundaries on further side.

Fuselage, upper surfaces of wings, empenage, and landing gear are two tone green. (Yellowish and dark.)

Under sides of wings are cream color.

Struts are bright yellow.

Exhausts are brassy gold.

Stars on wheels are white with blue field and red centers.

Hat with white brim, red and white stripes, and white stars in a blue field, is encircled by a black ring.

Hispano-Suiza Engine
220 H.P.

High Speed Approx.
135 M.P.H.

The Hummer 28 Twin-Pusher Model

A Flyer with a Record of 234 Seconds

By George S. Burrill, Jr.

THIS little model is a great flyer, and has the advantage of being easier and cheaper to construct than the large twin-pushers. It has a record of 234 seconds, with an average flight of 120 seconds.

Fuselage or A-Frame

The fuselage is made of ⅛" x ¼" x 28" balsa longerons. Place them on a table or bench with the ⅛" sides on top and bottom. Then cut a taper ¾" long on the inside of both longerons so that they will fit together easily and evenly to hold the front nose hook, as shown in drawing. Now spread the longerons as shown in drawing, so that there is 8" between longerons at the back end of the frame. Keep in this position with thumb tacks.

Now place the bamboo front brace A, which is 1/32" square and 2" long, so that it is 7" from the nose of the fuselage.

Next take the two center bamboo braces B, which are 1/32" x 1/16" x 7 ¼", so that the front ends are 5" from the first cross brace, and are 6" apart.

The rear cross braces C, which are of 1/16" square bamboo 9" long, are 4 11/16" from the center cross brace and the rear ½" from the bearings.

Now line up the longerons, making sure they are even, and then ambroid the braces in positions.

The six cans are made of .018 piano wire and are ¼" in diameter, as shown in drawing. Cement in place and be sure the open sides all face upward.

THE nose hook is also made of .018 piano wire and is ½" long with ⅛" loops.

The bearings are made of sheet metal 1/32" thick and 3/32" wide. They should be made ¼" high and with a ¼" foot to attach to motor sticks. Ambroid securely and make sure they are level. If necessary bind with thread.

Wing

The wing is made of two spars 21" long and ⅛" wide by 3/32" thick. Streamline the edges. The dihedral is 1" on each side. The ribs are made of 1/16" x 1/32" x 3½" bamboo, and are bent to correspond with the rib curve E shown in the drawing. Make seven ribs and ambroid in position as shown in drawing.

Cover with Japanese tissue paper, using paste. Be sure paper is smooth and cover on top only.

Elevator

The elevator is constructed the same as the wing, using balsa spars 1/16" square and 8" long. There are five ribs made of 1/16" x 1/32" x 3" bamboo, and are bent to correspond to the rib curve D shown in drawing. Ambroid in place as shown in drawing, and cover with Japanese tissue same as was done with the wing. The incidence bridge is made of .018 piano wire, and is ¼" high as shown. Ambroid securely to the leading edge of the elevator, making sure it does not lean. The dihedral is 1".

Propellers

THE propellers are carved from balsa blocks 8" x 1¼" x ⅝". Mark them out as shown in X and Y. Carve them the same as you would any X-type propeller. Be sure to carve one right hand and one left hand. The propeller shaft is made of .026 piano wire, and is 1¾" long with a ¼" loop for the rubber motor. Be sure it is in the exact center, and that the propellers are evenly balanced.

Assembly

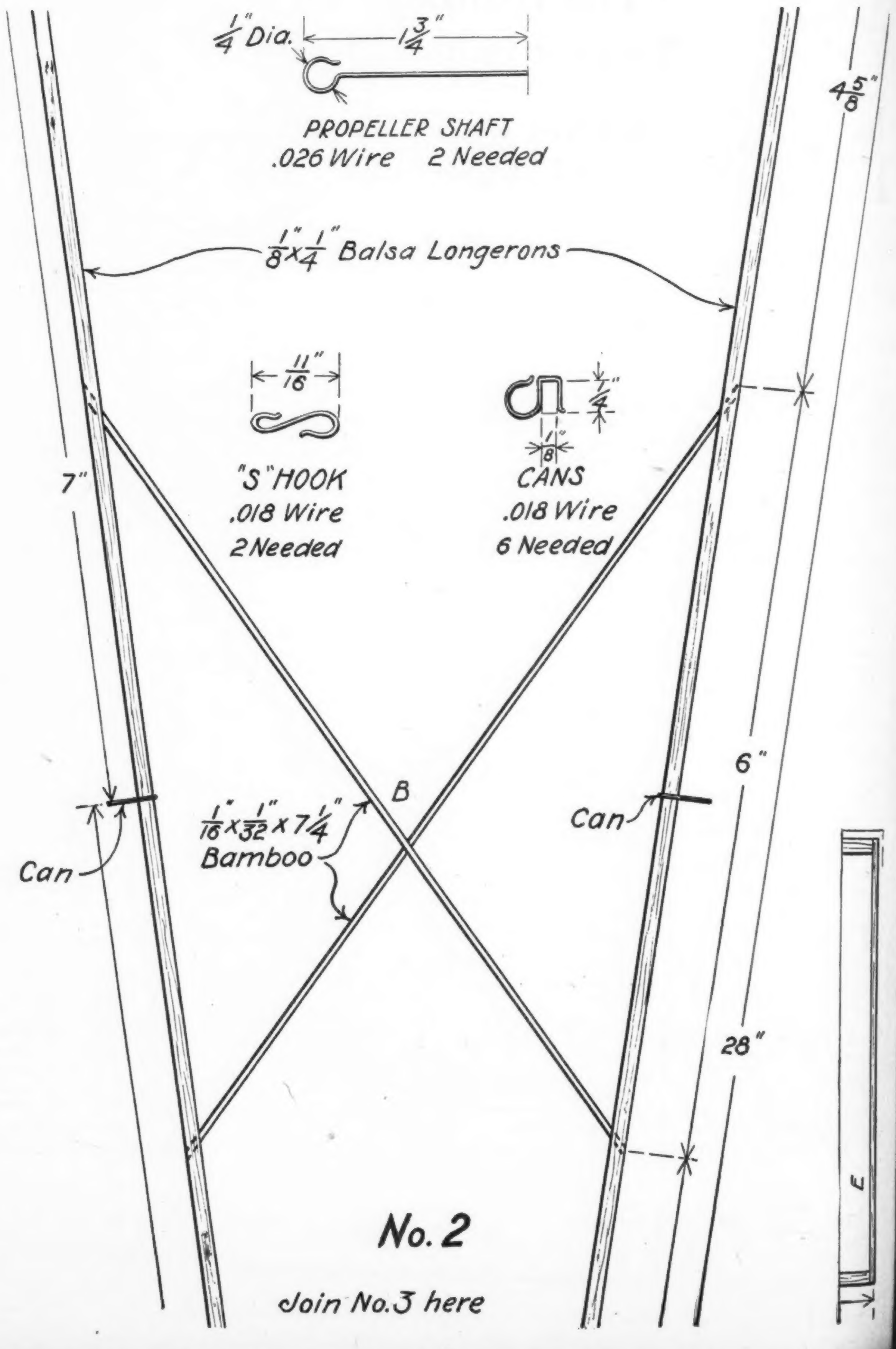
In assembling mount the propellers first, so that they turn in opposite directions to each other from the inside to the outside. The motors are then looped to make a four strand motor for each propeller. They are then placed in the propeller shaft and connected to the nose hook by means of the "S" hooks. They are made of ⅛" flat rubber.

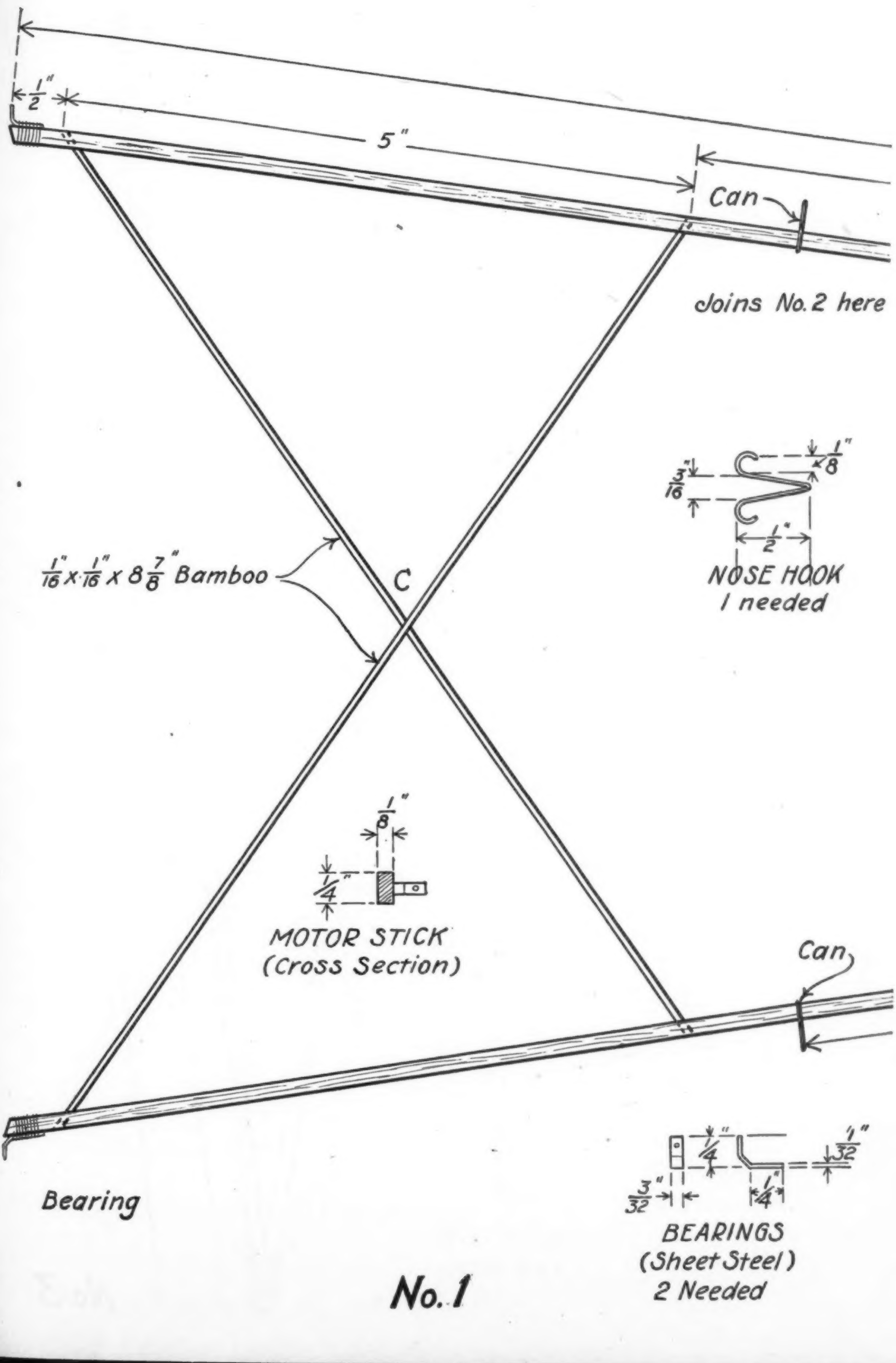
Use 3" rubber bands to hold the wing and elevator in place. The approximate positions are the elevator about 3" from the nose, and the wing about 5" from the propellers.

Necessary Material

2 pieces balsa	1/8" x ¼" x 28"	fuselage longerons
1 piece bamboo	1/32" square x 2"	front brace
2 pieces bamboo	1/32" x 1/16" x 7¼"	cross brace
2 pieces bamboo	1/16" square x 9"	cross brace
2 pieces balsa	⅛" x 3/32" x 21"	wing spars
7 pieces bamboo	1/16" x 1/32" x 3½"	wing ribs
2 pieces balsa	1/16" square x 8"	elevator spars
5 pieces bamboo	1/16" x 1/32" x 3"	elevator ribs
2 pieces balsa	8" x 1¼" x ⅝"	propeller blocks
2 metal bearings	1/32" thick	

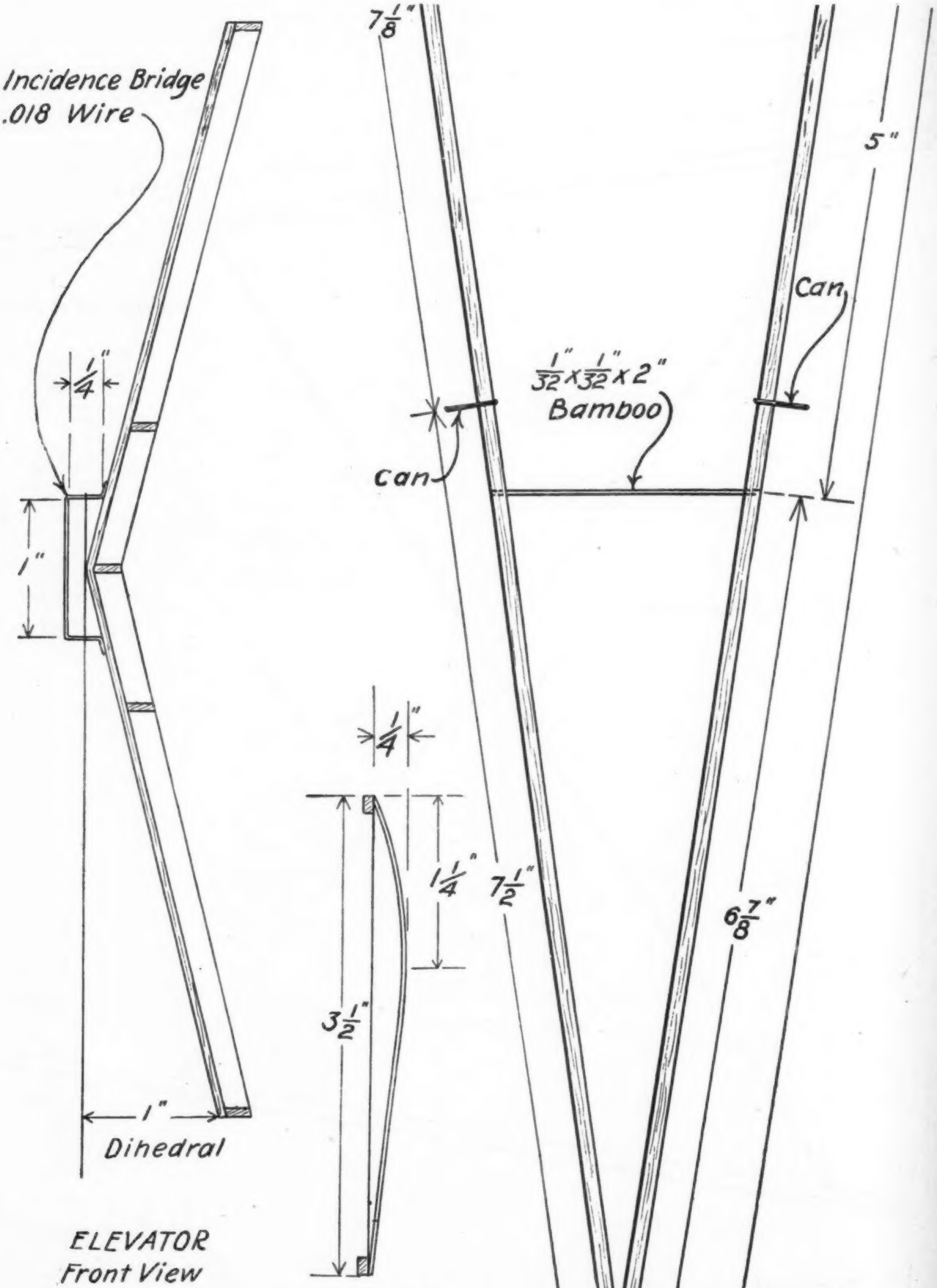
1 piece .018 piano wire 12" long for cans and nose hook.
1 piece .026 piano wire 4" long for propeller shafts.
20 feet of ⅛" flat rubber for two motors.
½ ounce of ambroid.
½ ounce of dope or paste.
2 "S" hooks .018 piano wire.
1 sheet Japanese tissue paper.
Silk thread
2 washers.

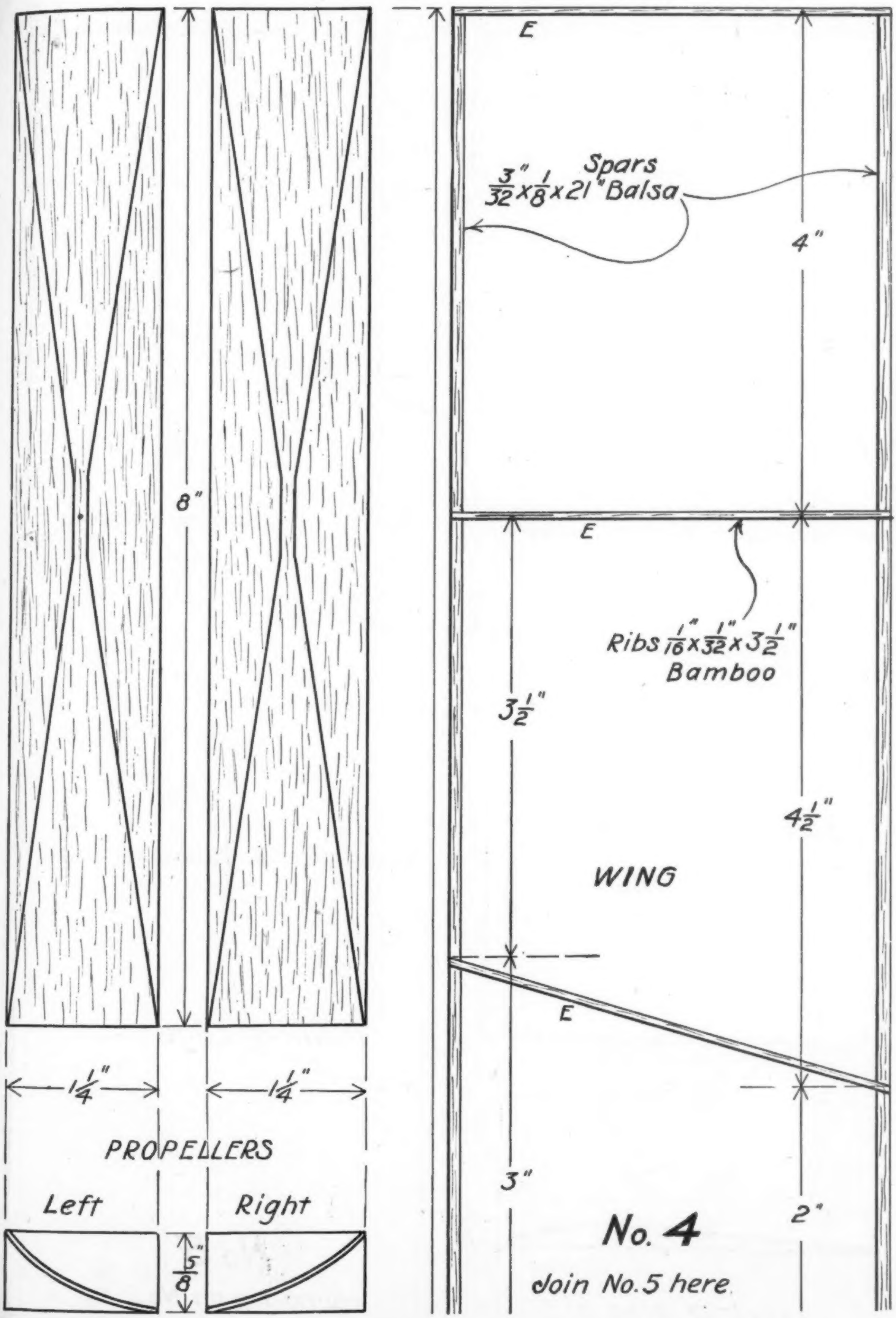

1/4" Dia.
1 3/4"
PROPELLER SHAFT
.026 Wire 2 Needed
1/8"x1/4" Balsa Longerons
11/16"
"S" HOOK
.018 Wire
2 Needed
1/4"
1/8"
CANS
.018 Wire
6 Needed
4 5/8"
7"
6"
B
1/16"x1/32"x7 1/4"
Bamboo
Can
Can
28"
E
No. 2
Join No.3 here

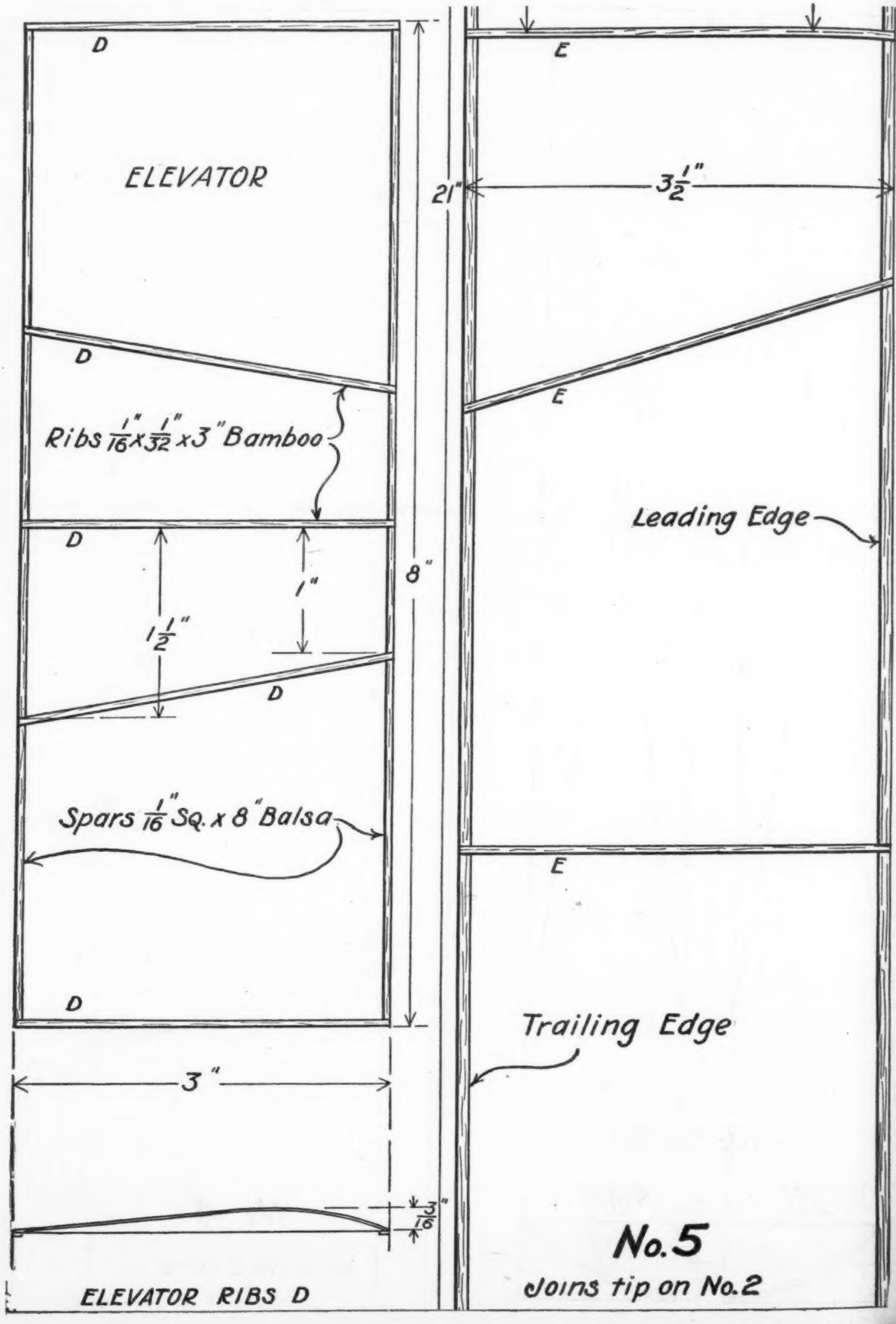


1/2"
5"
Can
Joins No. 2 here
3/16"
1/8"
1/2"
NOSE HOOK
1 needed
1/16" x 1/16" x 8 7/8" Bamboo
C
1/8"
1/4"
MOTOR STICK
(Cross Section)
Can
Bearing
1/4"
1/32"
3/32"
1/4"
BEARINGS
(Sheet Steel)
2 Needed

No. 1

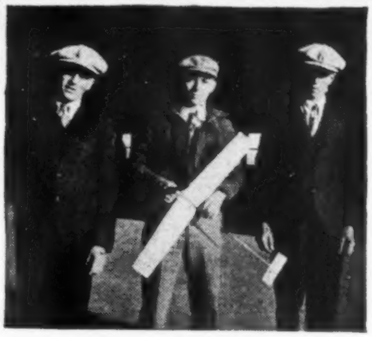

Incidence Bridge
.018 Wire
1/4"
1"
1"
Dihedral
ELEVATOR
Front View
1/4"
1 1/4"
3 1/2"
WING RIB
Full Size
7 1/8"
Can
1/32" x 1/32" x 2"
Bamboo
Can
5"
7 1/2"
6 7/8"
No. 3


8"
1 1/4"
1 1/4"
PROPELLERS
Left
Right
5/8"
E
Spars
3/32" x 1/8 x 21" Balsa
4"
E
Ribs 1/16" x 1/32" x 3 1/2"
Bamboo
3 1/2"
4 1/2"
WING
E
3"
2"
No. 4
Join No. 5 here


ELEVATOR
D
D
D
D
D
Ribs $\frac{1}{16}$" x $\frac{1}{32}$" x 3" Bamboo
$1\frac{1}{2}$"
1"
8"
Spars $\frac{1}{16}$" Sq. x 8" Balsa
3"
$\frac{3}{16}$"
ELEVATOR RIBS D
21"
$3\frac{1}{2}$"
E
E
E
Leading Edge
Trailing Edge
No. 5
Joins tip on No. 2

The American Sky Cadets





Sioux City, Iowa, Y.M.C.A. model airplane circus winners. Left: Stock models—Earle Johnson, third, James Cox, first and Ralph Youngberg, second. Right: Novelty maneuvering—Jay Hvistendhal, third, Oscar Manson, first, and Nels Manson, second. Centre: Indoor flying — Oscar Manson, third, Jay Hvistendhal, first, and Nels Manson, second

FIRST and foremost among the news items for this department this month comes from our old friend and Honorary National Commander, Mr. Roger Q. Williams, the famous New York-to-Rome flyer and one of America's great aviators.

He has two great surprises for American Sky Cadets, and model airplane enthusiasts in general. First of these surprises concerns a number of flights over and around New York City to be awarded in connection with a contest he will sponsor for us shortly. Details of the contest cannot be divulged at present, but watch for them in the columns of this magazine.

The second surprise is that he will pilot the lucky winners himself, and in addition will allow the boys to *handle the control stick* in the air, under his guidance, of course. How's that for something to hope for?

Mr. Williams, incidentally, is giving a great demonstration of what a successful flyer can do to keep himself fit at all times for big ventures that might arise by instituting a passenger carrying service at Floyd Bennett Airport, New York City's landing-field tribute to that famous airman.

John Tyskewicz, of Hartford, and Herbert W. Owen, of New Britain, Conn., high-point and hand-launched prize winners respectively of the Hartford Y.M.C.A. model tournament.

"Roger Q", as Mr. Williams is affectionately known, has a five-passenger Travel-Air cabin monoplane at the Floyd Bennett field, and it is in this machine that the prize winners will be flown. Incidentally, he also is going to start a flying school—and who would not like to be trained by such an outstanding pilot as "Roger Q"??

If any of you American Sky Cadets should visit Floyd Bennett field be sure to look for Mr. Williams and show him your pin or membership card. He'll be delighted to talk to you. And if you want to see how a plane should be handled just watch him land and take-off his Travel-Air.

NEXT comes an important communication from Mr. Charles H. Grant, Honorary National Commander for the New England States. The letter in full, reads:

"Have you heard about the new sensational twin pusher and how it won the Mulveyhall Trophy for its young builder? We will tell you how it happened. Our story starts about four weeks before the day of the contest at Franklyn Field, Boston.

"Several serious minded young fellows of Keene, N. H., suddenly felt a desire for fame as well as the bite of the "aeronautical bug". They talked models, dreamed models, and lived entirely with this thought in their minds. To build a model that would win the big contest and the New England championship. Having decided upon a course of action they paid a visit to their old friend and leader, Mr. Charles Grant, and asked his cooperation and help. Things began to move. Two days later there were several very busy boys, constructing with utmost care, a twin pusher of new design, worked out by their leader, Mr. Grant.

FROM that time on, it was a fight against time, for the preliminary contest with Manchester, N. H., was scheduled for the Saturday before the big contest at Boston. The planes must be built and thoroughly tested in order to compete in this preliminary meet with Manchester. The two winners would be the ones eligible to compete in the

Pilot Gene Shank (extreme left) of Hanford's Air Lines, congratulates Nels Manson on his Lockheed Vega Model. At the right are seen (l. to r.) Earle Johnson, James Cox and Ralph Youngberg, prize winners in the Sioux City Y.M.C.A. model airplane circus

big Boston meet.

"Finally, after many hours of concentration and rebuilding of certain parts in order to produce a perfect job, the day of the contest with Manchester dawned bright, clear and breezy. Excitement was high, for there was only one boy who was a veteran model flyer, and for the others it was a new experience.

"It was Paul Nordman, the veteran who had taken his first model plane to Springfield in 1930 and had startled everyone by breaking a national record with his Grant designed twin tractor, by a four minute flight of five thousand feet distance in a heavy wind.

"His companions were out to steal his glory if they could.

"The Manchester contestants finally arrived and after the models were weighed in, a few flights were made to insure proper adjustment, which gave promise of some fine official results. The flyers, however, were to be handicapped with a nasty down-draft. It was evident that no hope could be held for long flights with the help of rising air currents but that the planes would have to depend entirely upon the power and actual duration of the propeller thrust.

CARL HARVEY, of Keene, was the first to get his ship into the air as Manchester was delayed by several mishaps to their models. And what a flight it was. The sturdy ship climbed with great power, even under poor air conditions. It rose higher and higher in broad circles, finally coming back to earth on a long, beautiful glide from a 200 foot altitude. It was clocked at 133 seconds as it disappeared behind some houses before it landed.

"It was evident that the plane was good for long duration flight under right conditions. The climb was strong, the flight was steady, even in a wind, and it glided perfectly, on a true steady course.

"This first flight was somewhat of a shock to the Manchester boys, and they never quite got over it for the rest of the day. It took the starch out of them, so to speak, for after many attempts, the best they could show with some well built models, was 57 seconds. This perhaps, might be attributed to the poor flying conditions but which made the performance of the Keene boys all the more commendable.

"Other Keene contestants pressed Carl Harvey closely with flights of 120 seconds and 127 seconds. One of these flights was really longer than the best one timed at 133 seconds but the model flew so far that it went out of sight and was picked up later far beyond the point where the watch was stopped.

"The two winners, Carl Harvey and Leslie Jenkins, were on 'pins and needles' because of this, their first taste of victory and of the thought that they would now have a 'crack' at the Mulveyhall trophy at Boston. Then, too, they had beaten the Keene expert model builder, Paul Nordman.

Here's a challenge! Robert C. Morrison (above) of 500 Garfield Ave., Jersey City, N. J., claims to have blueprints or three-view layouts of practically every airplane in existence. He's prominent in American Sky Cadet activities

ONE week later, a caravan of 'blood-thirsty' young mdel fliers from Keene, N. H., arrived at Franklyn Field, Boston. And what a day it was. The wind was blowing at thirty miles an hour! The Keene boys felt that was an advantage for they knew what their models would do under these conditions. They had been designed with unusual qualities of stability from data collected by Mr. Grant over a period of twenty years of experimental work. Through the use of design formulas developed from this data, their models had required no change in design from their original conception, for everyone had flown perfectly under all kinds of conditions from the very first test flight.

"However, their confidence was lowered slightly by the realization of the size of the job ahead of them when they saw the line of two hundred other competitors, waiting to have their models weighed in, and for the first part of the contest they proceeded to be afflicted with that disconcerting malady, 'Buck Fever'. It was not until many futile and disastrous attempts had been made by their competitors to launch their planes in the treacherous wind that the realization of possible success brought them back to life.

"Then it was Leslie Jenkins who did the trick. After letting his motors slip while winding them up, and repairing the consequent broken wing paper, he launched his plane into the breeze. And a real flight it was, too, for the plans never wavered, even in the hard wind. Here its excellent design qualities showed to good advantage.

"Up, up, it climbed while the other unsuccessful contestants stood spellbound in amazement, gazing after the quickly disappearing model. Across the field, it was driven by the wind with plenty of altitude after a circle or two. The timer was watching it closely. Now it had reached the boundaries of the field and was out over the city. Still it flew on into the city's haze and finally disappeared entirely as the stop watch clicked at 108 seconds.

"Not long duration to be sure. If only the whole flight could have been clocked it might have been something to brag about, but there was no need for greater duration.

"Jenkins, a thirteen year old boy, had swept himself into first place and glory with this meager flight. The airworthiness and stability of his plane, in poor air

(*Continued on page* 39)

How to Make a

CO_2 Gas Engine Model

A Unique and Practical Motor for Model Planes

By Major H. W. Landis

A UNIQUE, altogether new, yet a very practical and superior motive power for model airplane engines is carbonic acid gas in compressed form, chemically known as CO_2.

This gas, easily obtained at most drug stores in small steel cylinders, is known under the commercial name of "Sparklets." They measure 2½" long by ¾" in diameter and although made of highly tempered steel, weigh but ¾ oz. each when filled with gas.

The pressure within this cylinder is very high but as they are intended to be used in charging soda siphon bottles at home, they are very safe to handle.

The gas content of one of these cartridges is sufficient to charge one quart of water in a special siphon bottle and still produce within the quart size a pressure of one hundred pounds to the square inch.

This is a much greater volume of gas than is possible to compress into tanks of larger dimensions as those sold by model airplane supply houses and which are charged with air by a foot pump to a pressure of sixty pounds to the square inch. Model engines, taking into consideration that there is such a greater volume of compressed gas in the sparklet than there is air in feather weight tank mentioned, will give flights about three times the duration when using the (Sparklets) cylinders than when using light weight tanks and compressed air.

Since a much longer flight is obtained and the power equipment weighs approximately the same in each case, we have, therefore, a much greater gain in power plant, in model airplanes as a whole, due to the fact that we accomplish so much more work with the same overall weight.

In order to harness the power of these cylinders to any model airplane, it is necessary to construct the simple device illustrated in drawing No. 1.

Another of the famous training planes of the wartime—an Avro two-seater. It was recognized as one of the most stable planes of the day

Each steel cylinder is sealed with a lead plug and in order to use this plug it must be pierced in such a manner that all the gas does not escape at once and while it allows the gas to flow to the engine evenly, there must be no leakage.

The arrangement shown in sketch No. 1, shows the device with the cylinder attached and a pipe leading from it for supplying the engine with the gas from the cylinder.

Between the end of the cylinder and this pipe is a control valve. This valve, due to its construction, is commonly known as a needle valve. It is not necessary to put such fine work into its construction as it does not serve as a means of shutting off the high pressure from the cartridge but rather as a means of controlling the speed of the engine by reducing the pressure, allowing for a short speedy flight or one of longer duration as the model owner wishes. It can be understood from this, that the valve may be allowed to leak somewhat. However, the threads on the valve stem should fit very snugly into those in the valve body.

In the construction of the valve it will be best to proceed as follows. First construct the valve body, then stem and handle—this manner of construction allowing for a better fit.

The valve body is made from a piece of brass rod ¼" square by ⅜" long. The sides are filed until it becomes 3/16" in thickness. Filing is irksome work and while the valve body can be constructed from the brass rod in the original size, still it is a desirable feature with most model aircraft builders to eliminate excess weight. The valve body is shown clearly in drawings No. 3 and 3A. Drill a very small hole through the brass body from end to end, using a No. 60 drill. Then drill a 3/32" hole in the side until it meets with the No. 60 hole. This hole will be ¼" from the end of the valve body as in illustration No. 3. It serves as an outlet passage for the gas from the cylinder to the supply pipe, then to the motor.

The No. 60 hole is enlarged by drilling with a No. 48 drill for the distance shown in drawing 3, or in other words, until this enlargement passes the 3/32" hole drilled in the side. This enlarged hole is tapped to the bottom with a No. 2, fifty-six threads to the inch, tap commonly known as a "2-56 A.S.M.E. size tap."

THE valve stem is constructed from No. 2 screw stock brass rod and is shown in sketch No. 3A. A number 2-56 A.S.M.E. die is run on an end of this rod cutting the threads on it for a distance of ½". The handle of this valve stem is formed by merely bending this rod at complete right angles as shown in drawing No. 3A.

The threaded end is pointed to a round point by filing and fitted until it conforms with the bottom of the tapped hole in the body, thereby forming a seat.

To the short portion of the valve body is soldered a hypodermic needle (obtained by writing Parke, Davis & Co., Philadelphia, Pa.), as shown in sketch No. 1 and No. 2,

taking care not to draw the temper from the point of the needle by overheating.

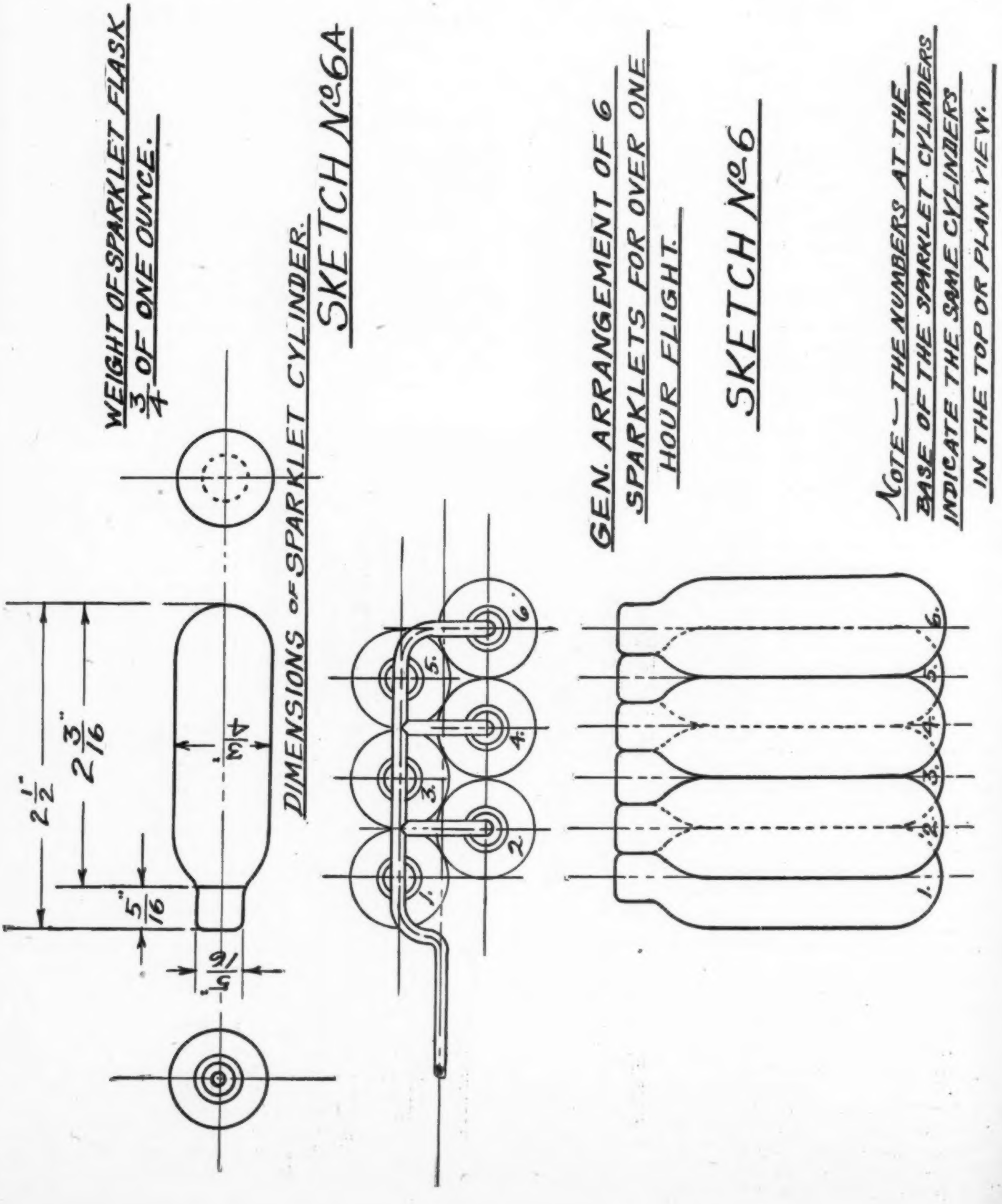
The hypodermic needle is a hollow needle used in medicine for making injections into a human or animal body and be sure when ordering to specify a bacterin size

Over the side hole in the valve body solder the brass tube which conveys the gas to the motor. This tube is bent and fitted as shown in sketches No. 2 and No. 3.

The purpose of the hypodermic needel is to puncture the lead seal in the end of the Sparklet cylinder. The hole made in the lead is rather small and due to the nature of lead allows little or no leakage of gas between the needle and the lead of the gas passing through the centre of the needle.

However, it is necessary to have a more secure means of attaching these cylinders to the needle than by merely pushing them on. This difficulty is overcome by attaching a small balsa wood plug ¼" in diameter and ¼" long, as shown in sketch A, drilling and counter boring same as shown in sectional view, sketch A, heeding the note under the drawing.

The internal contour of this plug is such that it fits



snugly about the shank of the needle and the plug is secured by using either airplane dope or ambroid cement.

A piece of 1/4" rubber tubing is cemented over the balsa plug as shown in sketches No. 1 and No. 3. This tube serves to grasp the neck of the (Sparklet) bottle, holding it firmly in place as indicated in drawing No. 1.

This completes the power plant, having only one pressure cylinder as a source of supply, and will keep the average model craft in the air for about eleven minutes when using a two cylinder opposed 1/2" stroke, 1/2" bore model aircraft engine.

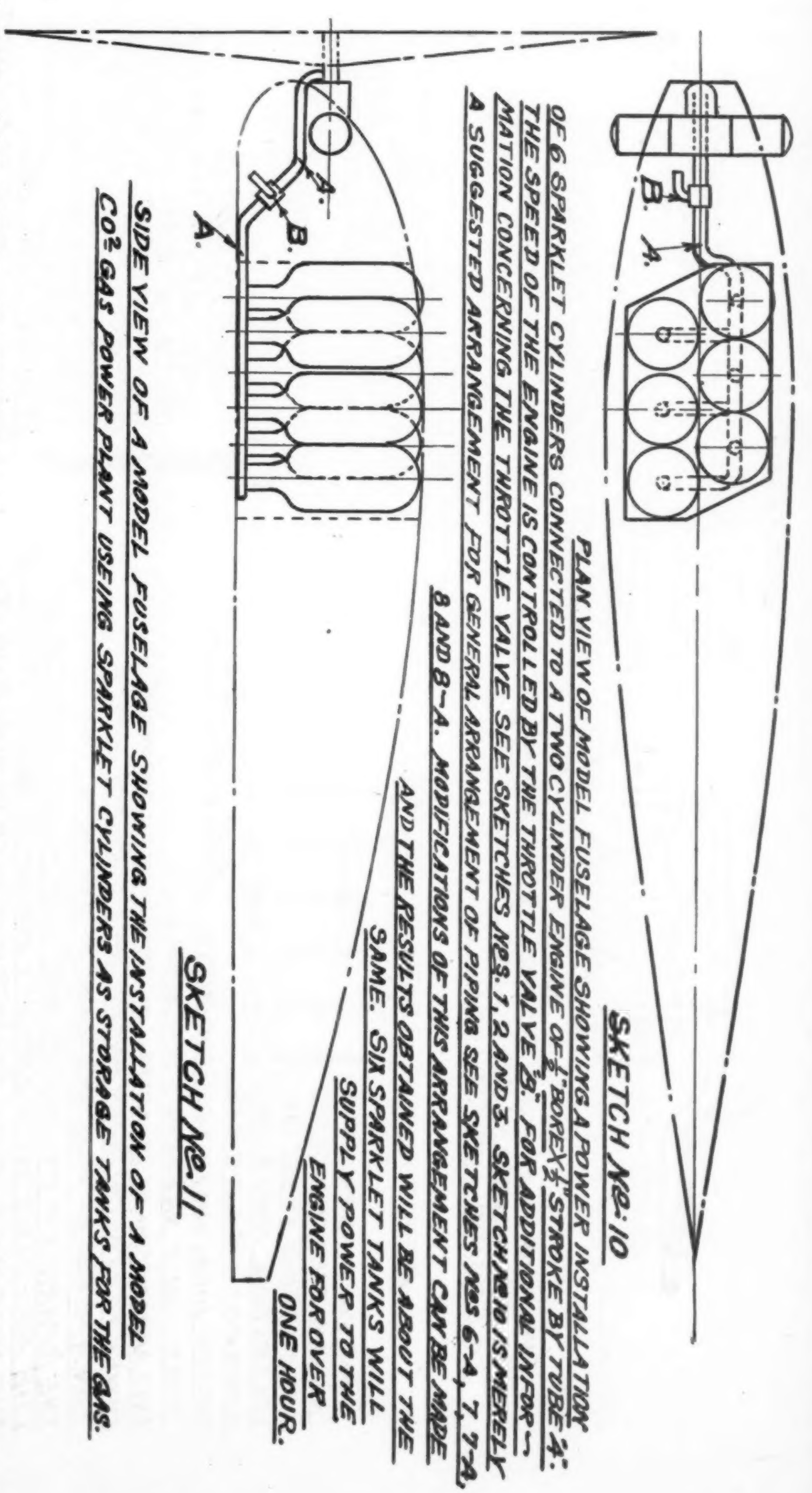
Multiple Power

In order to drive a model plane greater distances than would be possible when using a single cartridge of CO_2 gas, it becomes necessary to use a multiple arrangement of the cylinders as shown clearly in sketches No. 6 and No. 6A. When such a piping arrangement is made it is only necessary to file "V" notches in the main tubes as shown in sketch No. 7 and point the branch pipes as shown in Sketch No. 7A so that they may fit snugly in notches cut in the main line tube, and be soldered in place to form the assembly shown in sketches No. 8 and No. 8A. The piercing needles are supplied with small steel bearings 1/32" in diameter.

The balls act as check valves while placing the cylinder in position preventing the escape of gas through them until the controlling needle valve is turned on.

The steel ball is placed in the shank of the needle before same is soldered to the tube, as shown in drawings No. 10 and No. 11. The cylinders can be made either to stand on the needles (in which case, the ball bearings are

(*Continued on page 47*)

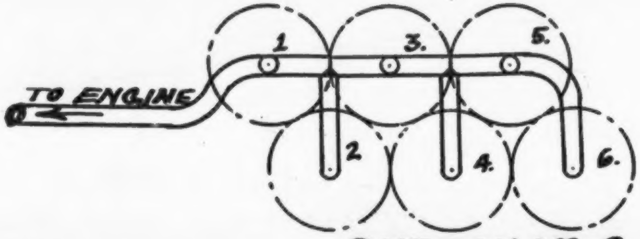


SKETCH No. 10

PLAN VIEW OF MODEL FUSELAGE SHOWING A POWER INSTALLATION OF 6 SPARKLET CYLINDERS CONNECTED TO A TWO CYLINDER ENGINE OF 1/2" BORE X 1/2" STROKE BY TUBE "A". THE SPEED OF THE ENGINE IS CONTROLLED BY THE THROTTLE VALVE "B". FOR ADDITIONAL INFORMATION CONCERNING THE THROTTLE VALVE SEE SKETCHES Nos. 1, 2 AND 3. SKETCH No. 10 IS MERELY A SUGGESTED ARRANGEMENT FOR GENERAL ARRANGEMENT OF PIPING SEE SKETCHES Nos 6-A, 7, 7-A, 8 AND 8-A. MODIFICATIONS OF THIS ARRANGEMENT CAN BE MADE AND THE RESULTS OBTAINED WILL BE ABOUT THE SAME. SIX SPARKLET TANKS WILL SUPPLY POWER TO THE ENGINE FOR OVER ONE HOUR.

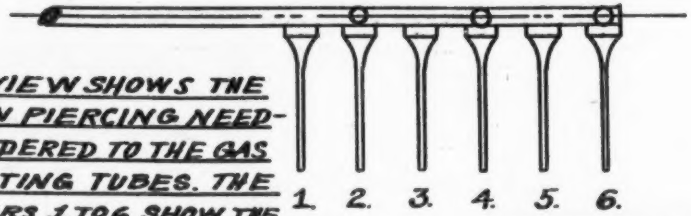
SKETCH No. 11

SIDE VIEW OF A MODEL FUSELAGE SHOWING THE INSTALLATION OF A MODEL CO_2 GAS POWER PLANT USEING SPARKLET CYLINDERS AS STORAGE TANKS FOR THE GAS.



SKETCH No 8

SHOWING PLAN VIEW OF THE ARRANGEMENT OF SIX SPARKLET CYLINDERS AND CONNECTION OF THEM TO ENGINE SUPPLY TUBE.



THIS VIEW SHOWS THE HOLLOW PIERCING NEEDLES SOLDERED TO THE GAS COLLECTING TUBES. THE NUMBERS 1 TO 6 SHOW THE PROPER LOCATION IN THE TOP VIEW.

SKETCH No 8-A.

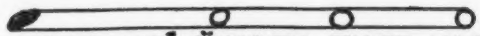
NOTE — SEE SKETCHES Nos. 6 & 6-A.

THIS ARRANGEMENT IS CAPABLE OF SUPPLYING CONTINOOUS POWER TO A TWO CYLINDER ENGINE OF $\frac{1}{2}$" BORE BY $\frac{1}{2}$" STROKE FOR A PERIOD OF TIME IN EXCESS OF ONE HOUR.

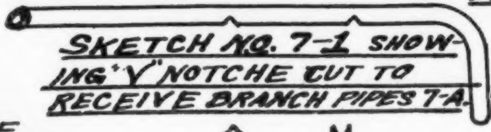
THE SPARKLET CYLINDERS ARE CAREFULLY FORCED ON THE NEEDLES WITH A ROTARY MOTION SO AS NOT TO BREAK THE NEEDLES. EACH CYLINDER IS HELD IN PLACE ON ITS NEEDLE BY MEANS OF A BALSA PLUG AND PIECE OF RUBBER TUBING AS SHOWN IN SKETCHES No 1 AND No 3.

THE ENGINE THROTTLE VALVE SHOWN IN SKETCHES No 1 No 2 AND No 3 IS PLACED IN THE LINE LEADING TO THE ENGINE AS SHOWN IN SKETCH No 11. THE POSITION OF THIS VALVE MAY BE SHIFTED SO AS TO BE HANDY IN THE PARTICULAR PLANE IN WHICH IT IS INSTALLED.

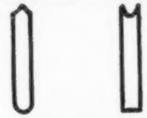
SKETCH No 7



SHOWING "Y" HOLES FILED IN FEED PIPE TO ENGINE. THESE HOLES RECEIVE THE BRANCH PIPES 7-A.



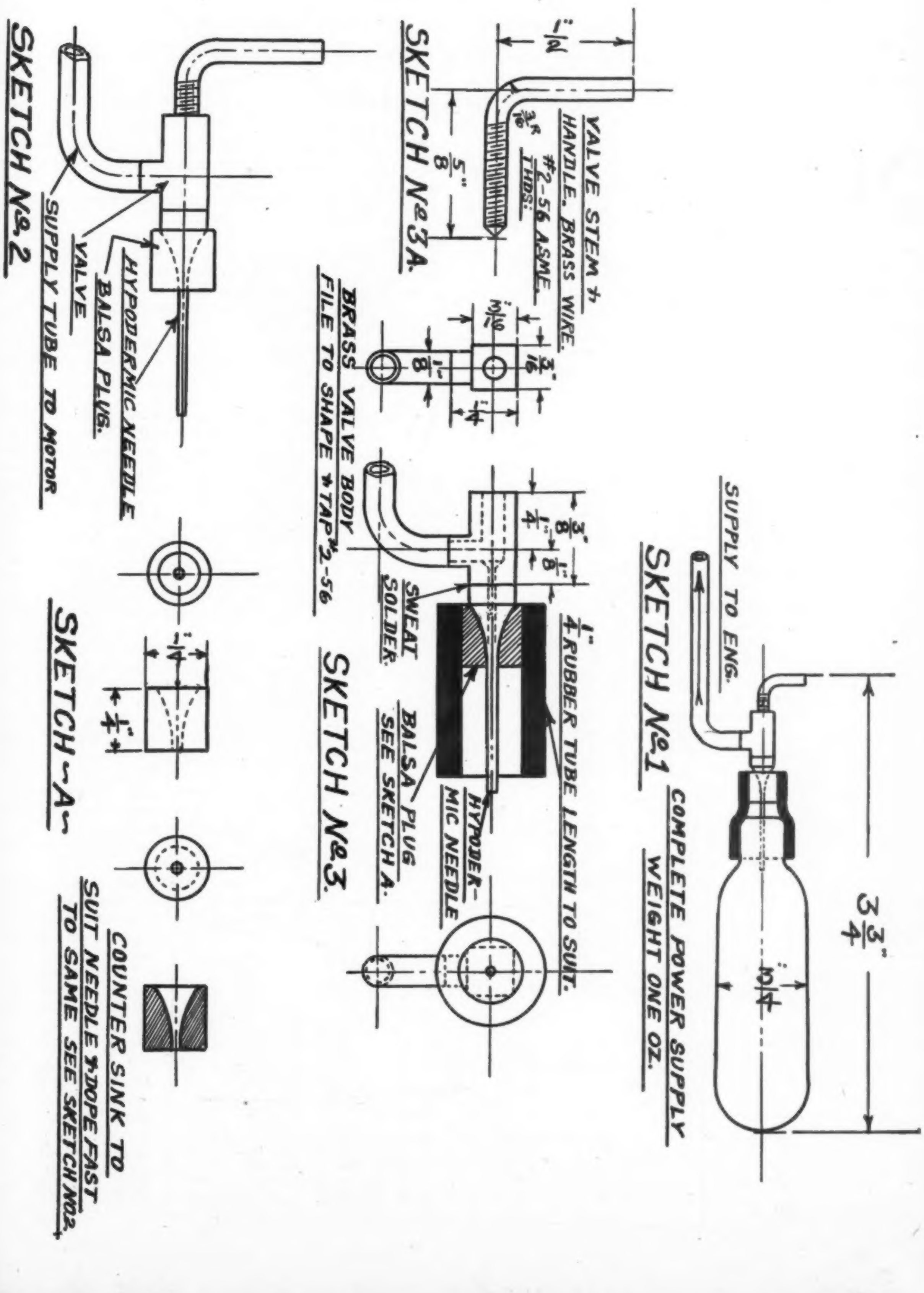
SKETCH No. 7-1 SHOWING "Y" NOTCHE CUT TO RECEIVE BRANCH PIPES 7-A.



SKETCH No 7-A. SHOWING BRANCH PIPES FILED TO FIT IN "Y" NOTCHES IN MAIN SUPPLY PIPE SHOWN IN SKETCHES Nos 7 & 7-1

SKETCH No 9.

SHOWS A PIERCING NEEDLE WITH A $\frac{1}{32}$" DIAM. STEEL BALL SUCH AS MADE BY BEARING COMPANIES PLACED IN SHANK OF NEEDLE AND ACTS AS A CHECK VALVE ALLOWING GAS FROM SPARKLET CYLINDERS TO ENTER THROU POINT OF NEEDLE BUT NONE TO FLOW OUT OF POINT. THIS BALL IS PLACED IN NEEDLE SHANK. BEFORE SOLDERING NEEDLE TO TUBE


SKETCH No. 1
COMPLETE POWER SUPPLY
WEIGHT ONE OZ.
SUPPLY TO ENG.
3 3/4"
1 1/4"
SKETCH No. 3A.
VALVE STEM & HANDLE. BRASS WIRE.
#2-56 A.S.M.E. THDS.
3/16 R
1/2"
5/8"
3/16"
3/16"
1/8"
1/4"
BRASS VALVE BODY
FILE TO SHAPE & TAP #2-56
SKETCH No. 3.
3/8"
1/4"
1/8"
1/4" RUBBER TUBE LENGTH TO SUIT.
SWEAT SOLDER.
BALSA PLUG SEE SKETCH A.
HYPODER-MIC NEEDLE
SKETCH No. 2
HYPODERMIC NEEDLE
BALSA PLUG.
VALVE
SUPPLY TUBE TO MOTOR
SKETCH ~A~
1/4"
1/4"
COUNTER SINK TO SUIT NEEDLE & DOPE FAST TO SAME SEE SKETCH No. 2.

A Course in Airplane Designing

By Mastering This Valuable Course, the Model Builder of Today Lays the Cornerstone for His Career as the Aeronautical Engineer and Designer of Tomorrow

M.B.

By Ken Sinclair

Article 22.

MANY airplane designers, as we learned last month, are by no means satisfied that the present type of plane is the safest and most efficient that can be built. These men are constantly searching for and developing new ideas—the autogyro, the tailless planes, the numerous helicopters, and so on.

Both of the ships that we discussed last month—the canard, or tail-first plane, and the pterodactyl, which gets along without any tail at all—operate on the same basic principle as does the more conventional airplane. That is; they sustain themselves by moving rapidly through the air and pushing down on the air as they go. However, the canard and the pterodactyl, as pointed out in the previous article, are so designed that they cannot be stalled and spun.

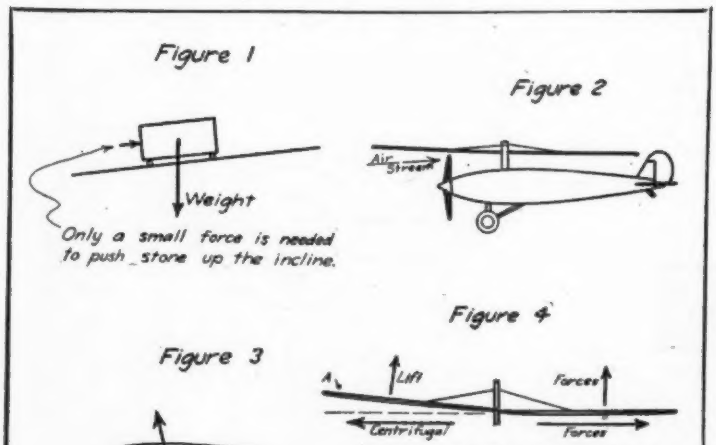
The designers of these planes are trying to beat the stall and rob the "tailspin" of its danger by doing away with it altogether.

Now we come to another set of designers; those who are trying to build planes that will land on and take off from a very small patch of ground or a city roof. These gentlemen contend that the airplane, to become a successful and valuable vehicle for the private owner, must first be made capable of using any backyard as its flying field.

First and foremost, of course, come the helicopters. A helicopter, according to the dictionary, is "a flying machine sustained by propellers turning on vertical axes." The definition, while rather cumbersome, is quite all right with the exception of the regrettable fact that most helicopters do not manage to "sustain" themselves; or at least not for any length of time.

The idea of the helicopter, however, is an old one. We know that a propeller, when turned rapidly by an engine of some sort, develops a *thrust force*. In the airplane, this thrust force is used to pull the ship through the air so that the wings may develop the lifting force that sustains the ship.

Now, say the helicopter enthusiasts, why all this useless complication? Why not simplify the thing by using the propeller to lift the machine directly, cutting out all the useless weight of the wings; and have a real flying machine that will be able to rise vertically out of a city street and come down to a safe landing in a backyard? What's the use of dragging around these huge wings, anyway, when the whole job can be done by the propeller? Well, as someone has put it, "Wings may be useless and all that, but I'd hate to be up there without them!"



It all boils down to this; no helicopter ever built has proven a success. We must grant that several machines of this type have succeeded in prying themselves off the ground pulling themselves up by the bootstraps, we might say; and one machine of Italian make has actually remained in the air for some time, held down by cables in captive-balloon fashion, but these few half-successes do not alter the facts of the case a bit.

The helicopter may seem very nice at first glance, with its promise of vertical ascents and descents. The basic principle of the thing, however, is inefficient.

WHY? Simply this; no airplane or helicopter propeller ever built has approached the efficiency of the wing. However, you say, a propeller is nothing more than a couple of wings attached to a shaft so that they may be revolved rapidly. True—but the propeller *revolves*, and this circular motion creates a swirling current of air that extends for some distance in front of the prop. Thus it is that the propeller blades are operating in disturbed air, whereas the airplane wing moves through practically undisturbed air and thus develops its full efficiency. There are other reasons for the comparative inefficiency of the propeller but we have not the space to deal with them here.

The helicopter, then, is working under a disadvantage because a great amount of its power—more than twenty or thirty per cent, usually—is wasted; but the ordinary airplane propeller suffers this loss of power, too; and it manages to pull the plane along through the air pretty well. The difference is this; the ordinary airplane propeller supplies only the force necessary to overcome the drag of the plane and keep the ship moving, while the helicopter must provide the entire lifting force. In other words, the helicopter cannot afford this loss of power due to the comparative inefficiency of the propeller.

Let us compare the two methods of flight—helicopter and airplane.

Suppose we were lifting a block of marble, weighing two tons, a distance of one hundred feet. Suppose that the task had to be done by two men. It is ob-

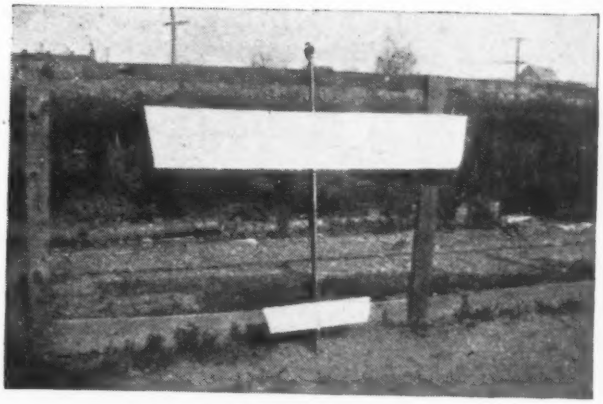
(*Continued on page* 36)

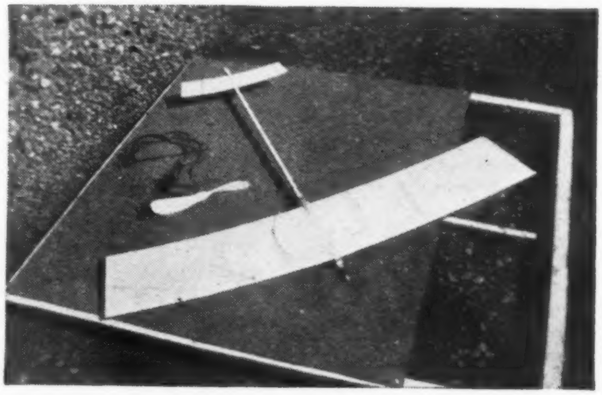
How to Build a

"Canard" Flying Model

Propeller Dropping Device Doubles Endurance

By Prof. T. N. de Bobrovsky





WIND tunnel tests with flying models show that the drag is highly increased when the motor is in exhaust and the propeller stops or revolves slowly. In proportion, in flying models we use larger diameter propellers than we do in airplanes, it is natural, then, that the drag increase will be greater. This decreases the gliding angle of the model while it also decreases the duration or distance.

That is the reason why flying models, after climbing to a great height, glide rapidly back to earth.

Normally, it is very seldom that a gliding ratio of more than 1 to 8 is obtained. It is obvious, that if there was not increased drag the gliding ratio could be as high as 1 to 15 or more; and the duration of a model with flat gliding angle increases greatly.

To decrease or eliminate this drag, it is necessary that either we have the propeller working slowly until a landing is made or we drop all parts which might help to augment the drag. It is possible that the propeller will revolve freely after the rubber motor is exhausted, but there will be a certain amount of drag increase with this method also.

With the other method of dropping the motor and propeller, we not only eliminate the drag increase, but decrease the original drag as well. Then, the model will glide or soar, and possibly fly longer than when flying with motor.

This method was used in Germany by Curt Mobius, the famous model builder, and by myself in Hungary and in Italy successfully. One and one half hours flying with a 3-ft. model was not unusual with this system. I lost a number of models in this way, but the fun or observations made during the flight, were of more value than the loss.

It is neither complicated nor difficult to make a model of this type. For dropping the propeller and motor a small spring made of wire is all that is necessary and takes but five minutes longer to make. The balance, however, is another question. It is necessary that the position of the center of gravity remain intact before and after the drop, moreover the drag center must move after the drop to avoid a bad effect. To produce these we could hardly use a tractor model, although it would not be an impossibility.

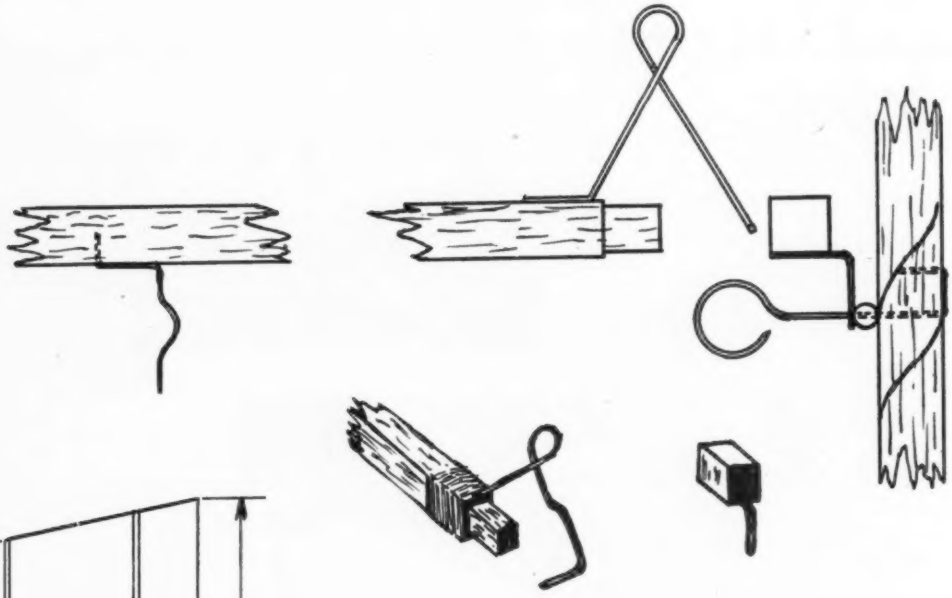
I built one of this type, but it was too complicated. A simpler method is to use a pusher model, with a front stabilizer. First, this is the only type of airplane or model, which is automatically stable. Second, the flying qualities of this type are better than the tractor.

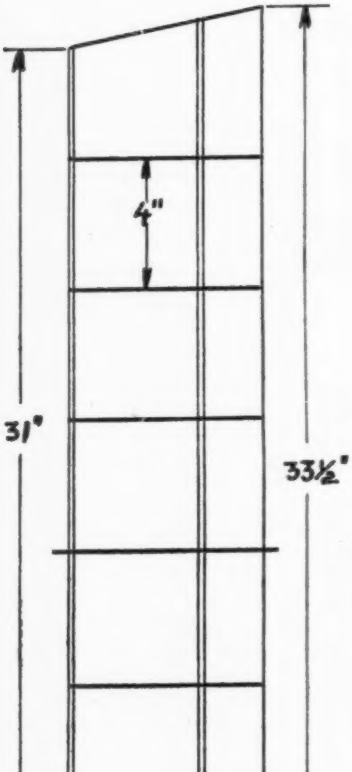
This type is known internationally as the "Canard," which is the French name for duck. The duck when flying with his head and neck stretched forward has the same shape as a model with a front stabilizer.

Not all pusher propeller models are of the Canard type. It is wrong to use only the name "pusher" for all models, that are built with the propeller at the back. For instance, the Penaud type, on which the propeller is placed in back of the tail, is a pusher but not a Canard. The old Farman type of plane, on which the propeller is placed behind the wings, has not only front elevator, but also has biplane type of tails, is a pusher, but not a Canard.

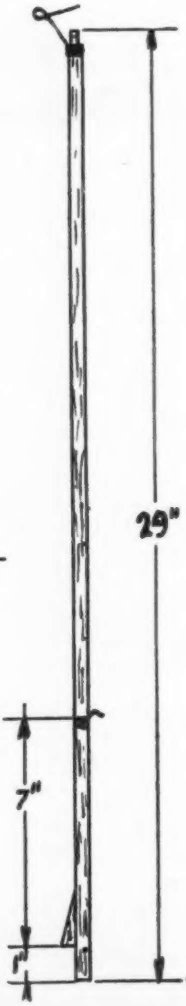
The old German Gotha bomber airplane, has two pusher propellers behind the wings and does not have front wings. One can readily see that the name "pusher" is not sufficient to cover all classes, because we can think of at least four different types of airplanes or models. The original Canard or duck was designed by the Wright Brothers, but the longitudinal equilibrium was not obtained by the same method that is used for the Canard of today.

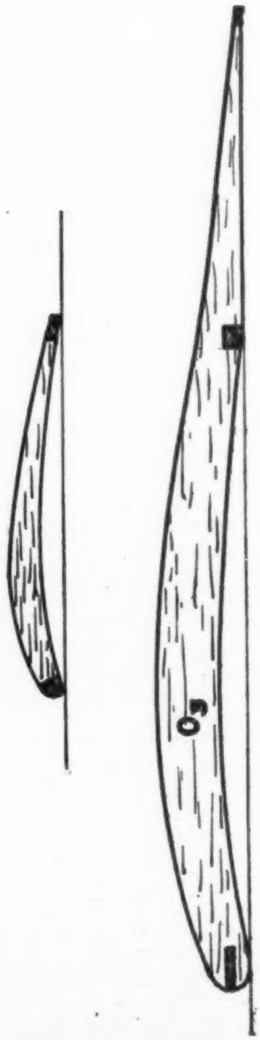
BLERIOT, Voisin, Bristol, Szekely and others designed and built Canard airplanes without success. Voisin's attempt was partly successful. One may ask, what is the difference between the full sized Canard and the model? The models of this type fly so well and still one does not see full sized ones in the air. This is very simple. After the first few unsuccessful attempts with these Canards, nobody was interested enough to make any research. I know of only three private persons or corporations, who were or are seriously interested in its advancement. The first is the German Focke-Wulf Airplane Co., which spent two years in research and tests to (*Continued on page* 38)



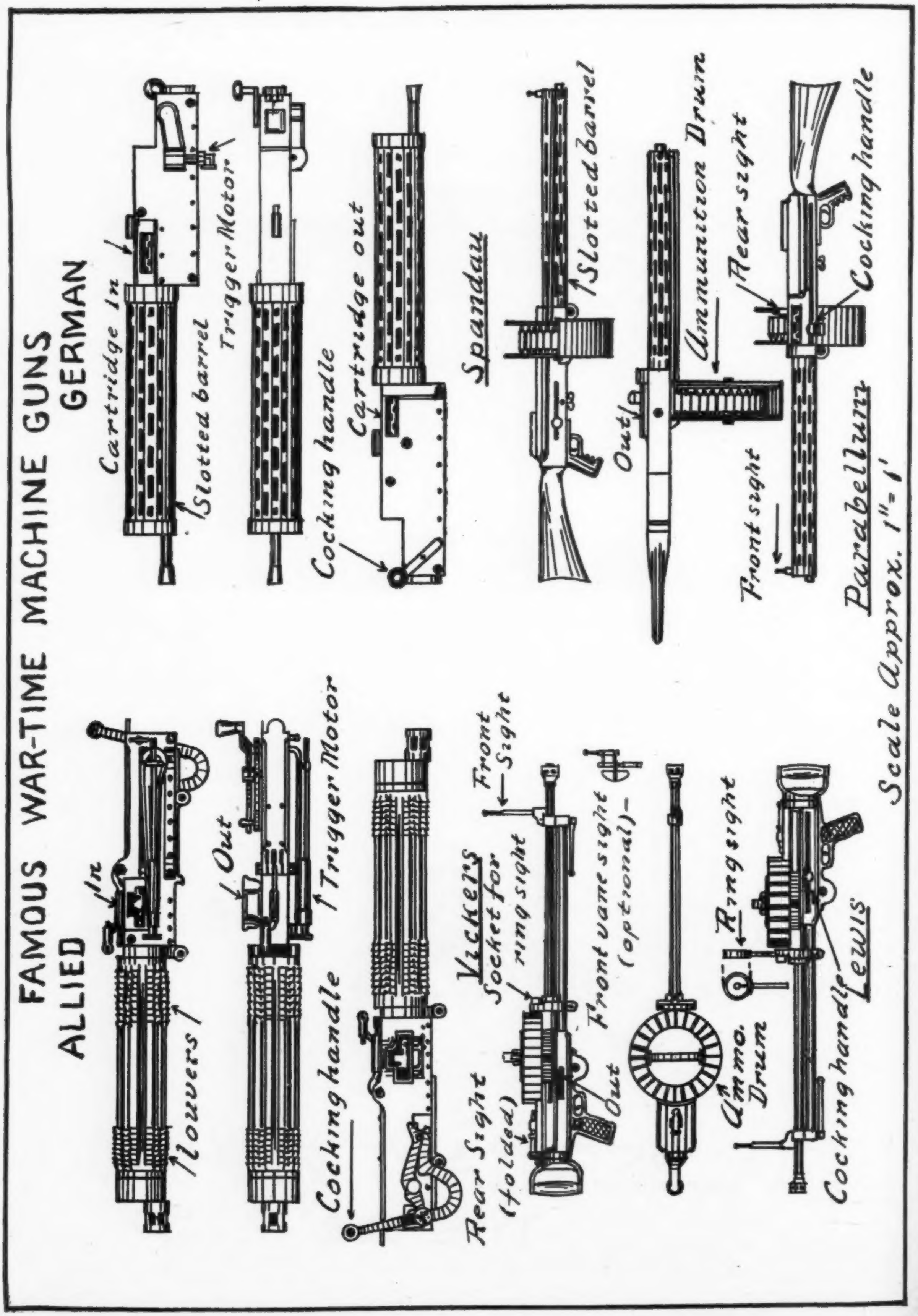

4"
31"
33½"


9½"
10"


29"
7"
1"



AN ACTUAL, UNRETOUCHED OFFICIAL WAR PHOTOGRAPH
of one of the famous German *Halberstadt* single-seater fighters


FAMOUS WAR-TIME MACHINE GUNS
ALLIED
GERMAN
In
Louvers
Out
Trigger Motor
Cocking handle
Vickers
Socket for ring sight
Front Sight
Front vane sight (optional)
Rear Sight (folded)
Out
Ring sight
Ammo. Drum
Lewis
Cocking handle
Cartridge In
Slotted barrel
Trigger Motor
Cartridge out
Cocking handle
Spandau
Slotted barrel
Ammunition Drum
Out
Rear sight
Cocking handle
Front sight
Parabellum
Scale Approx. 1"=1'

Aviation Advisory Board

Conducted by
Capt. H. J. Loftus-Price
EX-ROYAL AIR FORCE
CHAIRMAN OF THE BOARD

I AM receiving so many letters from our readers asking how, what, where, and when they can obtain positions in this wonderful industry of aviation that I think it best to reproduce, for the most part, what the Department of Commerce, Aeronautics Branch, has to say on the subject of "Aviation Training."

Read it carefully and study every phase outlined. The bulletin reads as follows:

The rapid progress of aeronautics and the natural increase of public interest, particularly in aviation, has aroused a widespread desire for entrance into this field of employment. As in every other industry, there are openings for trained men of experience, but the peculiar requirements of aviation are such that the most careful consideration should be given before a selection of a special phase is made.

Some of the positions which may be obtained after proper training and experience are as follows:

1. Pilot.
2. Mechanic.
3. Aeronautical engineer (airplane or engine design).
4. Factory man.
5. Airport designer and constructor.
6. Airplane ground man (helper).
7. Radio operator (airport or airplane).
8. Traffic agent.
9. Advertising and publicity man.
10. Salesman.

There are other positions of extremely specialized or executive nature, but, as a rule, training in one or more of the branches indicated will fit men for such positions.

The question of openings in these phases of aviation is one that can not be answered definitely. A variety of factors must be considered as in any other business.

A pilot with several hundred hours of experience in all kinds of flying, including cross-country work and night and fog operations, will obviously be more valuable to a transport company than one who has had less time in the air and whose experience has been grained at airports alone.

However, this is not to be taken as an indication that there is no place for the pilot with less flying time and experience. The Department of Commerce recognizes this by granting limited commercial licenses to pilots with 50 hours solo flying time. These licenses authorize their holders to carry passengers for hire within a restricted area around an airport. An industrial license is granted for the same amount of flying time. This permits a pilot to engage for flying for hire in certain operations, such as cotton dusting, aerial photography, etc., but not to carry passengers or property for hire between States.

THE Air Commerce Regulations should be carefully studied to obtain full knowledge of the qualifications and privilege of licensed pilots.

The ability of the individual is always a governing factor, but the deciding factor is, of course, the state of the industry. No attempt can be made to estimate this closely.

Pay for pilots varies. On most contract mail routes pilots receive a base pay with a percentage for miles flown with mail. Other pilots engaging in miscellaneous commercial operations may receive straight salaries or commissions. Pilots operating independently carrying passengers at airports usually receive from $2 to $5 for each passenger carried on short flights. The amount in each case usually depends upon the service performed, the locality, the method used, the equipment, and the reputation of the flying personnel.

The rule of supply and demand will always apply fully to the opportunities for employment as a pilot.

Good airplane and engine mechanics are usu- (*Continued on page 45*)

A remarkable view of a F okker D-7 for your wartime collection

(*Continued from page* 30)

vious that two men, without block and tackle, could not lift an object weighing two tons. However, they could easily get that chunk of marble to its destination by building an inclined plane, as the ancient Egyptians did when they built the pyramids; and, with the chunk of marble on rollers, push it up the grade quite easily.

The same amount of work, in the strict sense of the word, would have to be done in either case—whether the block were lifted vertically or pushed up the incline—but it would take a lot less power to get it up the incline. Take a look at Figure 1. Here we have the block of marble on the incline. Its weight rests on the rollers. Only a comparatively small force is needed to push the block up the incline, whereas, if we were to try to lift it vertically, the whole force of two tons would have to be exerted.

That case is the precise parallel of flight. The airplane can fly and climb with comparatively little power exerted through the propeller because the force needed to overcome the drag and a very small portion of the weight is much smaller than the force that would have to be exerted to lift the ship vertically.

Let us take a practical case. I have in mind a light airplane that carries two passengers. The motor develops forty horsepower when wide open; and the whole plane, ready to fly with passengers in the cockpits, weighs something more than eight hundred pounds. The small forty-horsepower motor, running at a little more than half throttle, will keep the plane in the air and moving along at a good clip. The thrust force exerted in this case is most certainly not more than a hundred pounds or so.

As you see, it is simply a case of efficiency. Instead of trying to lift that block of marble directly, we pushed it up an incline. Instead of trying to lift a plane directly by the propeller, we use fixed wings which carry the weight while the propeller keeps the plane moving through the air.

No helicopter has ever left the ground and remained in the air at anything less than full throttle, and continued running at full throttle means a terrific strain on the motor. Then, too, the helicopter cannot carry any added weight. The terrific power that has to be put into the vertical-lifting propeller necessitates a large motor—and a large motor, in turn, means still more weight to be lifted.

Summing things up; the helicopter does not seem to be a practical success, nor is it likely to prove practical in the future *unless some remarkable new and lighter powerplant is developed*. Even if this were the case, it is obvious that the airplane would still be more efficient than the helicopter.

It is true that some new principle may be discovered and change everything, but the helicopter as it is today does not stand much chance.

We should not pass on to the next subject without mentioning one of the most interesting helicopters ever built in this country — the Curtiss-Bleeker machine. Strictly speaking, this machine is a hybrid; half helicopter, half airplane. Instead of applying the motor power directly to the supporting propeller, Mr. Bleeker places a small propeller in the leading edge of each of the larger blades, or wings. These small propellers, in revolving, create thrust forces that revolve the large propeller—making it really a revolving-wing machine—and the larger blades, acting on the air, produce the lifting force. The machine has not, as yet, been hailed as a very great success; but it is an idea that may possibly be developed into something valuable in the future.

Airplane Designing Course

Now we come to one of the most interesting of modern flying machines, the autogyro. Juan de la Cierva, inventor of the autogyro, has brought an entirely new and radical principle into flying—and, unlike most entirely new developments, the autogyro has proven itself thoroughly practical and efficient. By "new development" I do not mean that the autogyro has come into existence during the past year or so. On the contrary, de la Cierva has been working on the idea for many years, developing it, improving it, and testing it.

We will take up some of the features of the autogyro first, and then, later, we will try to find out just how and why it works.

In the first plane, *the autogyro is not a helicopter in any sense of the word*. The revolving blades which sustain the machine are not connected with the motor while the ship is in flight. The machine does *not* rise vertically from the ground.

Many persons, when they see an autogyro in flight, exclaim, "Why, it's a helicopter! What makes the blades go around if they aren't connected with the motor?"

To put the thing in black and white, the autogyro is just about the direct opposite of the helicopter. It is a windmill plane. The rotor is driven by the airstream as the machine flies. Later on we will see how this is done.

One of the chief features of the autogyro is its amazing safety. It cannot be stalled. With the motor of the ship stopped completely a vertical descent can be made from almost any altitude in safety. Very steep climbs can be made because the danger of the stall is obviated. The pilot, when making a landing, flies over the spot where he wishes to land, cuts the motor, and calmly pulls the stick back. The ship settles to the ground and comes to a stop with a run of only a yard or so.

Don't try that with an ordinary plane!

Now, how does the autogyro work? That is a question that has been bothering many an air-minded person who has watched the machine fly. It seems rather strange, at first, that the rotor revolves freely in the air without being power-driven. It appears to be illogical, verging on perpetual motion, but the basic principle of the thing, when you get right down to it, is quite simple.

That revolving rotor is a windmill. It really consists of four wings which are free to revolve about the central axis, and the whole thing is tipped, in flight, at a slight angle to the air stream.

If we have a propeller in a stream of air, with the axis of the prop shaft parallel to the air flow, the propeller will revolve as a windmill. Now, when we turn the propeller so that it no longer faces the air stream directly, but at an angle, it will still revolve, although not, perhaps, as rapidly as before. Even at small angles of "attack," however, the prop will continue to revolve.

In the autogyro this windmill propeller is made up of four wings, each of them at a very small angle of attack. The plane of the rotor, as shown in Figure 2, is inclined at a small angle to the air stream. The whole rotor acts as a windmill.

However, there is another important effect that comes into play. At the small angles of attack of the blades themselves, the lift of the wing-section is actually inclined forward with respect to the chord line, as shown in Figure 3. Thus the wing is really coasting downhill like a glider, with part of the lift force helping it along—and all the while it is revolving about the central axis and producing its part of the total lifting force.

If the thing seems obscure at first, a little thought will clear it up. Each blade of the rotor is, in effect, a separate wing, coasting downhill all the time because of the inclination of the plane of the rotor to the air stream.

There were many difficulties to be overcome in designing the autogyro. It is plain that, if the rotor blades were fixed to the axis, there would be more lift on one side of the ship than on the other, due to the fact that the rotor blade, while it moves "forward" with respect to the ship, is traveling through the air faster than it is when it is moving "backward."

It should be mentioned here, perhaps, that the speed of the rotor is sufficient for the blade to be moving *forward* with respect to the air even while it is moving backward with respect to the ship (toward the tail of the ship.) This fact would naturally cause the autogyro to cant up on one side and tip over if something were not done to overcome it.

The designer has handled the difficulty by hinging the blades at their points of attachment to the axis. This hinging allows the blades to "feather," or adapt themselves automatically to the changes of position necessary to equalize the lift on both sides. This is shown in Figure 4.

When an autogyro is on the ground there is a perceptable droop of the rotor blades, or wings. This is due to the hinging mentioned above.

Then, too, this hinging makes for exceptional smoothness while the machine is in flight. When the ship strikes an air bump the hinged blades give slightly and take up the shock, and the machine rides smoothly at all times, even in rough air.

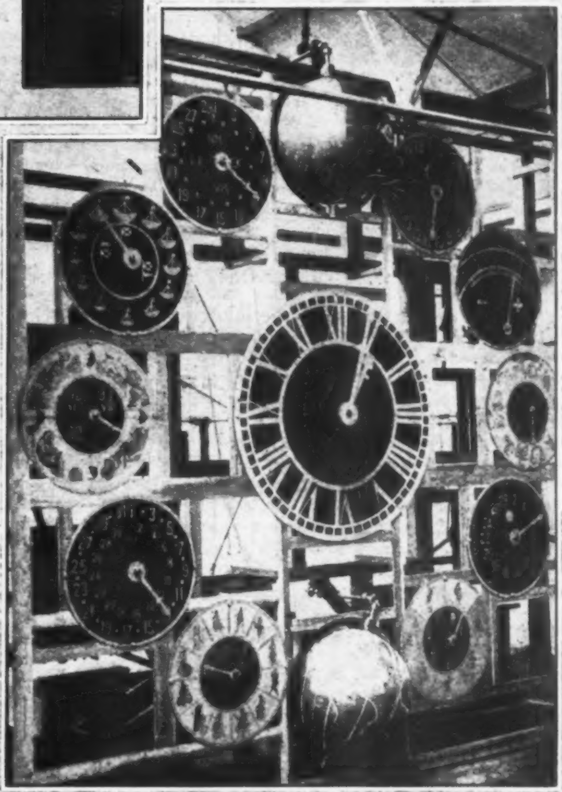
However, you say, if the blades are hinged so that they can bend upward, how can they support the weight of the ship? Without any bracing to hold them, why don't they just flop upward like the wings of an ordinary plane would if they were hinged, letting the whole machine fall to the ground?

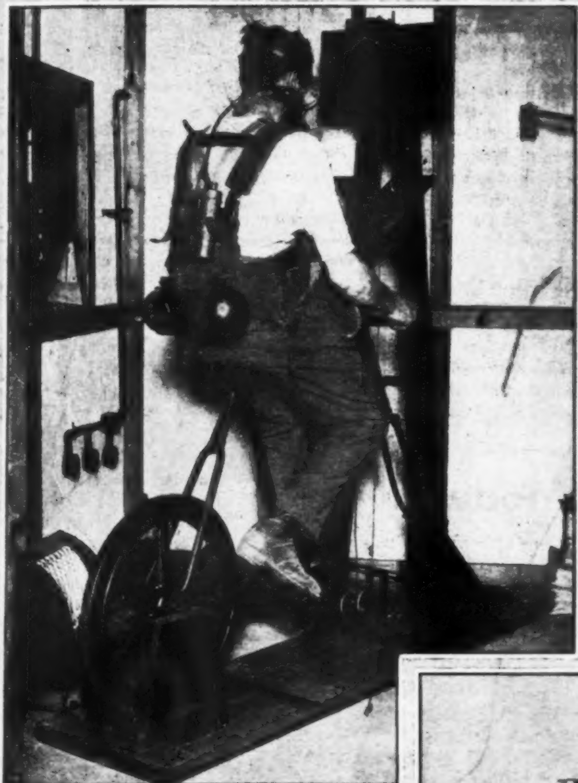
Centrifugal force holds the blades in position. The whole rotor is revolving at quite a speed while the ship is on the air, and the weight of the blades themselves naturally creates a strong centrifugal force that tries to pull the blades outward, holding them against the lift forces which are trying to pull them upward.

In starting an autogyro, it is necessary to have the rotor revolving before the machine can leave the ground. Formerly this start-

THE Swedish clock (left) denotes the time of all lands. The mechanism of a super clock (below) at Lierre, Belgium. Clock tells Greenwich time, Zodiac signs, planetary system, days of week, moon phases and tides

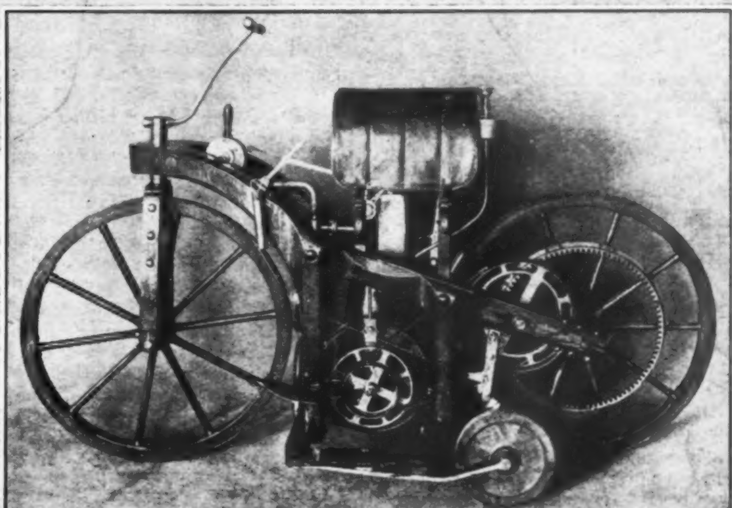
News Events





ENGLAND has schools where miners are taught life saving. Photo above shows a miner undergoing a cycling endurance test in a gas-filled chamber. The first motorcycle in the world with a Daimler motor is seen at the right

News Events



ing of the rotor was accomplished by taxiing the machine about the field, but the newest machines have a motor-driven shaft and a set of gears that can be engaged while the pilot is warming up the motor. Then, when the "windmill" is revolving at sufficient speed the pilot disengages the gears, opens the throttle wide, and the machine moves off down the field. Soon it lifts off the ground and climbs rapidly into the sky.

In case of motor failure, the "windmill" keeps right on working, even though the machine may be descending almost vertically. Each blade, as explained above, acts as a glider, revolving about the axis because of the forward inclination of the lift force, and the ship descends quite slowly.

The autogyro is indeed an interesting machine. We have touched on only a few of the points in connection with its theory and operation, but every aeronautical engineer is watching the development of the "windmill plane" with a great deal of interest.

There have been many machines, successful and unsuccessful, that have been built with the idea of attaining absolute safety in flight. One of the most interesting—and successful—of these is the Merril Safety plane.

In the Merril plane, longitudinal control is obtained by a system of moving the wings themselves. The ship, in its present form, is a biplane which looks rather like an ordinary plane until one inspects it closely. The wings are movable. Their angle of attack can be changed while the machine is in the air. No horizontal surfaces are needed for control. The pilot can set the wings to a certain angle of attack, take his hands off the controls, and sit back to watch the scenery while the ship flies itself down to a safe landing!

The advantage of this ship, of course, is its phenomenal ability to fly at widely varying angles of attack with safety and ease. The pilot can fly rapidly or slowly, as he wishes; all he has to do is to change the angle of the wing settings. Certainly this is a development to be watched.

Another machine which operates on somewhat the same idea is the Cornelius Fre-Wing. This job is a monoplane with a movable wing and small auxiliary surfaces extending behind the wing. Few details concerning this machine are available as yet, but it is said to have proven quite successful in trial flights.

So far we have discussed the canard, the pterodactyl, the helicopters, the autogyro, the Merril Safety-Plane, and the Fre-Wing. All of these ships—and many others that we have not the space to mention—operate on principles of flight or control that differ from those of the ordinary airplane. The inventors of these machines, as has been said, are seeking safety and efficiency in flight by building machines that differ more or less from the accepted airplane.

There is another "clan" of designers, however, who look at the thing differently. These men are trying to develop the present type of airplane, seeking, of course, the same ends as are the builders of the more unconventional ships. The adherents to the accepted airplane contend that their ships can be developed, through engineering skill and scientific research, until they are even more safe and efficient than they are today.

Every airplane designer must keep pace with the rapid progress of his science, so next month we will take a look at the work of these men who are developing the present day airplane into something better and still better.

Questionnaire

1. Explain the principle of the helicopter.
2. Why can an airplane lift a certain weight with less power expended than an helicopter?
3. Is the autogyro an helicopter?
4. Explain the operation of the autogyro.
5. Why are the blades of the autogyro rotor hinged?

The "Canard" Flying Model

(*Continued from page* 31)

produce Canard airplanes. The second is W. B. Stout, the designer for Ford airplanes. The third is the writer, who conducted research with about twenty tunnel and more than 300 flying models of this type, with spans measuring from 3 to 10 ft. I forgot to mention another name, the famous Junkers, who have both patents and designs for large Canard airplanes with special arrangements.

Basing my opinions on research, I firmly believe that the Canard type is one of the future types of pursuit, sport and commercial airplanes.

A good Canard needs a wing section with the least possible C.P. travel. For this you can use my airfoil, specially designed for this purpose, or I can recommend the Munk airfoils, for instance N.A.C.A. M-6; M-10; M-12; M-15 to 18, etc. It is necessary that the front stabilizer have an airfoil more cambered than the wing. A flat front stabilizer is not good. The stalling degree of the front stabilizer should be less than the wing.

For example if your wing should stall a 14°, it would be necessary that your stabilizer have a stalling point at 10-12°. The front stabilizer should have 2° more angle of attack than the wing. As the Canard type is the only one on which the stabilizer is loaded continuously, one should know the C.P. of the stabilizer, the wing and the combination of these two.

This is found, by making simple calculations. First, the important point is to know the area of the two surfaces.

Let us suppose, that the stabilizer has 20 and the wing 100 sq. inches in area. As the both of these are loaded while flying, the surfaces would total 120 square inches. Then again suppose that both have the same wing loading, it is a simple fact, that the stabilizer holds 1/6th of the total weight of the model, because $120 = 20 \times 6$. This will indicate that the C.P. of the surfaces must be 1/6th ahead of the C.P. of the wing. These few facts placed together prove to us that it is very important to know the exact location of the wing and stabilizer C.P. also the distance in inches of these.

When airfoils, which are copied from the N.A.C.A. reports are used, the location of the C.P. is given, but generally one can calculate on 30 per cent of the chord. Have the model set for flying, measure and mark on the wing and stabilizer the location of the C.P. Now measure the distance between the two C.P.'s and divide this with the number of the loading coefficient, which in this case would be 6.

Measure the result, starting forward from the wing C.P. and mark on motor-stick, which gives you the line of the C.P. of the model. If your thrust line (rubber motor) is below this, the C.G. of the model must be found about 1/2" to 3/4" in front of the C.P. point, depending on how far below the rubber motor or thrust line is. If your thrust line cuts the C.P. it is sufficient that the C.G. be only 1/16" to 1/8" before the C.P. If your thrust line be above the C.P. the C.G. location should be in the rear, but we do not recommend this.

Now you have some idea of how to calculate your model, and you are ready to start building the model, shown in the drawings and picture. One picture shows the model made from my drawings by Phillip Meehan, Dickinson High School student. The other picture shows the same type model, but with a 5-ft. wing span. This does not have a drop spring and was built by John Bausewein, also a Dickinson High School student.

First, build the wing. The airfoil is shown in the drawing. From 1/16" hard balsa sheet, cut 8 pieces, and one piece (center rib) from 3/8" soft balsa. For the front spar, use a 1/16" x 1/4" strip of hard balsa, and for the rear spar a 1/8" sq. strip. Ambroid the wing skeleton together, as shown in the drawing. After this glue a 1/16" x 1/8" strip for trailing edge. Now the wing is ready for covering, with Japanese tissue. Cover and dope both sides. The dope will give your wing a natural dihedral.

From 1/16" balsa sheet cut 5 stabilizer ribs. Use 1/8" sq. strips for the front, and 1/16" x 1/8" for the rear spar. Your attention is called to the tip ribs, which are V shape in both wings, also that the aspect ratio of the wing is 5 to 4 and for the stabilizer 4 to 3. Cover and dope the stabilizer in the same way.

Now for the motor stick, which is made from a 29" long and 3/8" sq. strip of medium balsa. In front of this, 1" distance glue a stabilizer holder, made from balsa, as shown in drawing. Glue the front hook 8" from the nose. The special form of this is shown in the drawing (upper left). Next form the other end of the motor stick, carefully, permitting a free way for the hanger holder, which is made of very thin metal, either soldered or glued. From wire, form a spring, curved as shown in the drawing, glue and with threads fix in the motor stick.

The propeller is 8" diameter and the same form that was printed the April number of this magazine. When you try the hanger pull in the stick and hook the spring under the hanger, the instant that the hanger is released, the spring drops this. Now, make a regular S hook and fix 6 loops of 1/8" flat rubber bands between the two hooks.

Wind up the rubber motor, hook the spring in the hanger and release the propeller. You will notice, that just as soon as the rubber motor is almost exhausted, the spring drops the hanger, propeller and motor.

Fasten the wing and stabilizer to the stick in the usual way, then, try and see if the model will glide without the propeller and motor. Now try with propeller and motor replaced.

(*Continued from page* 24)

conditions, had snatched the trophy from others with less engineering skill and foresight.

"It was all over but the shouting and applause of the assembled multitude, among whom were several flyers from the Boston airport. Within the next five minutes Carl Harvey clinched the glory for Keene when he took fourth place by a similar flight which landed his plane a quarter of a mile beyond the point where the clock was stopped at 80 seconds. In his case the wind was unfortunate for it carried his plane out of sight so fast that it was timed for only half of its actual flight. Fortunately, both models were eventually recovered. They had landed in one of the city streets.

'Man Alive,' one of the airport fliers was heard to observe, 'I wish we could build our large ships as stable as those two models. Why, we had to ground our ships today at the airport because of the wind.' We might add that large ships could be built with the desired stability if large ship designers would seriously and scientifically study aeronautics through the medium of flying model planes.

"Not only is model building and flying instructive but it is healthful and enjoyable. If you would like to know about it, ask Leslie Jenkins, the thirteen year old boy of Keene, N. H., who took home the Mulvyhall Trophy.

"For the benefit of those readers who might be interested in knowing the general specifications of this unusual twin-pusher, they are given as follows:

"*The frame* is of the (Vee) type, built

American Sky Cadets

up of two $\frac{1}{4}$ inch square hard balsa sticks 40 inches long channeled out to form an (I) section. These are beveled and joined at the front. At the rear ends, a 3/64" wire spreader 12" long separates them. The whole is flexibly strengthened at the center of the frame by wire cross bracing of 1/32" wire. 'Cans' are at the half way point. These are also made of 1/32" wire, as are the motor hooks at the front of the frame.

"There are two propellers which are cut from balsa blocks 12 x $1\frac{5}{8}$ x 1 inch. This gives a pitch of about 22" and a blade area for each propeller of 14 sq. in. or a total of 28 sq. in.

"Nine strands of $\frac{1}{8}$" x 1/32" rubber drive each propeller. The main wing is 36 inches in span with a $4\frac{1}{4}$" chord and built up aerofoil section, the top camber of which is $\frac{5}{8}$" high. The lower surface has a 3/32" camber. The highest point of the top surface camber is 30 per cent of the chord back from the leading edge. The wing tips are rounded.

"The construction is original. The wing is formed by a sheet of 1/32" balsa as the upper wing surface, to the under side of which the ten ribs are cemented, a narrow 1/32" balsa strip $\frac{3}{4}$" wide forms the lower leading edge. The rear edge is stiffened across the four center panels by cementing balsa strips $\frac{1}{4}$" x 1/32", to it. Two inches back of the leading edge, strips of balsa 1/16" x 3/16" are cemented between the ribs running parallel to the span of the wing. The top surface is cut away between the ribs from $1\frac{1}{4}$" back of the leading edge to within $\frac{3}{8}$" of the trailing edge.

"These openings are covered with Japan tissue paper. The under side of the wing is then also covered with Jap tissue. The wing is then cut in the middle and the two halves rejoined with a dihedral angle of such value that each wing tip is raised $1\frac{1}{2}$" above the center point of the upper surface. The elevator of the front wing is made in a similar manner.

"It has a span of 14", a chord of $3\frac{1}{2}$" and a top surface camber of 7/16". The dihedral angle is such that the wing tips are raised $1\frac{1}{4}$" above the center point of the wing surface. The rear wing lies flat on the frame sticks while the leading edge of the front wing is raised $\frac{1}{8}$", to give an angle of incidence of about (4) degrees."

(*Editors Note: Pictures of the prize-winner of the Mulveyhall Trophy, and the model plane he used will be published in the next issue of* MODEL AIRPLALNE NEWS).

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WE are indebted to Mr. Merrill Hamburg, secretary, the Airplane Model League of America, for the following complete results of the A.M.L.A. Fourth National Contest at Dayton, Ohio.

It was in this contest that Emanuel Feinberg, of Detroit, Mich., staggered the model airplane world by flying his model for 1,770 seconds—approximately $29\frac{1}{2}$ minutes!! A remarkable performance and worthy of the winner and his prizes—the Stout Trophy, a Trip to Washington, D. C., and \$100 in cash. Complete results on next page.

WINNERS OF THE NATIONAL OUTDOOR CONTEST

Airplane Model League of America

Place	Time	Contestant	Address
First	340 Sec.	Steve Klazura $200 in cash Trip to Washington Bronze Plaque of Roosevelt	Chicago, Ill.
Second	320.8 Sec.	Jack Purvis $100 in cash	Toronto, Ont.
Third	296 Sec.	Ernest Pinkert $75 in cash	St. Louis, Mo.
Fourth	290.4 Sec.	Alan Loofbourrow $50 in cash	Columbus, Ohio
Fifth	287.2 Sec.	Vernon Boehle $30 in cash	Indianapolis, Ind.
Sixth	283.5 Sec.	Ralph Kummer $20 in cash	St. Louis, Mo.
Seventh	237.8 Sec.	Elmer Lueckerath $15 in cash	Ferguson, Mo.
Eighth	225 Sec.	Arthur Mott $10 in cash	Cleveland, Ohio

WAKEFIELD INTERNATIONAL TOURNAMENT

Place	Contestant	Address	Time (Seconds)	Wakefield Cup
First	Joseph Ehrhardt	St. Louis, Missouri	264.8	$50.00
Second	Elmer Lueckerath	Ferguson, Missouri	217.8	25.00
Third	Richard Herrick	Champaign, Illinois	207.2	
Fourth	E. N. Bullock	London, England	162	
Fifth	Albert Levy	Toronto, Ont. Canada	151.5	
Sixth	Ross Farquharson	Vancouver, B. C. Canada	138	
Seventh	Edward Becvar	Chicago, Illinois	118.8	
Eighth	Edward Miller	Oak Park, Illinois	106	
Ninth	C. F. Saunders	Middlesex, England	95.4	
Tenth	Robert Syer	Battle Creek, Michigan	83.7	
Eleventh	Dick Hiscocks	Toronto, Canada	62.8	
Twelfth	J. Pelly Fry	London, England	52.4	
Thirteenth	J. W. Kenworthy	Manchester, England	45.3	

Models entered which did not make official flights

James Chamberlin .... Toronto, Ont. Canada
H. G. Kempton .... London, England

THE STOUT FUSELAGE CONTEST OUTDOOR

Place	Time (Sec.)	Contestant	Address
First	1770	Emanuel Feinberg $100 in cash Trip to Washington Stout Trophy	Detroit, Mich.
Second	1061	Kenneth Diget $50.00 in cash	Battle Creek, Mich.
Third	968	Richard Herrick $25.00 in cash	Champaign, Ill.

SCALE MODELS

1st place—Boeing P-12 B 98%	Gordon Lamb Trip to Washington $200 in cash Bronze Plaque	Oakland, Calif.
2nd place—Lockheed Sirius 97%	John Roche $100 in cash	Kansas City, Mo.
3rd place—Vought Corsair 94%	Quan Gue Cheong $75.00 in cash	San Francisco, Cal.
4th place—Vought Corsair 93½%	C. Nelson Black $50.00 in cash	Columbus, Ohio
5th place—Lockheed Sirius 91%	Clarence Sharp $30.00 in cash	Kansas City, Mo.
6th place—Boeing P-12 B 89½%	Matthew Mozick $20.00 in cash	Springfield, Mass.
7th place—Fleet 87%	George Schairer $15.00 in cash	Bronxville, N. Y.
8th place—Curtiss Seaplane 86½%	John Seswezyk $10.00 in cash	Springfield, Mass.

Airplane Engine Course

(Continued from page 11)

back and returns through the primary coil to the opposite side of the condenser where the same bouncing action takes place. This oscillation continues until the energy is expended. Actually, several oscillations take place though it requires not over one twenty-thousandth of one second for the entire operation.

As this rapid oscillation takes place, a magnetic field is being built up and broken down around the coils each time the current changes direction. These lines of force cut the secondary coil which is composed of 13,000 turns of very small copper wire. As the field cuts these many conductors a high secondary voltage is built up which is sufficient to arc across the sparkplug gap. Again it is noted that the secondary electromotive force is alternating. It has a value up to 15,000 volts and of about one four-thousandths of an ampere.

Ordinarily, the plug will spark at a much lower voltage than is made available. The excessive voltage provides against the time when extra resistance such as oil between the electrodes of the plug will require a higher voltage.

The high secondary voltage is led to a distributor which consists of a revolving conductor which makes contact with the cylinder segments at the instant the peak of voltage is reached. Ignition leads convey the voltage from these segments to the sparkplugs in the proper cylinders.

Note that the entire ignition operation requires only a fraction of a second—at the most one ten-thousandth of a second. Further, the high secondary voltage results from the opening of the breaker points. The breaker points, then, determine the instant of firing of the plugs. When the points open the distributor arm is in contact with the proper cylinder segment. Therefore, to time the magnetoes to an engine the operator merely has to adjust the breaker points to begin to open at the time of the engine cycle that he wants any particular cylinder to fire.

In order to stop an engine it is necessary to stop the ignition. This is done by inserting the switch "S" in the primary circuit. By closing this switch the breaker points are shorted out. The primary circuit is completed through "S". Consequently, the points do not break the circuit and the secondary does not have a sufficiently high voltage induced into it to fire across the plugs.

Actually, this switch is placed in the cockpit in order that the engine operation can be controlled by the pilot. He is able to use either magneto, both, or neither, depending on the position of the switch arm.

In case a sparkling lead should become disconnected there would be no outlet for the high voltage when the distributor comes in contact with that segment. The safety gap is provided to operate in this event. This gap offers more resistance than the plug gap, but less than the insulation of the leads. Since the voltage can not escape across the sparkplug it expands itself across the safety gap. Thus, the insulation of the leads and the secondary coil are not burned out as would be the case otherwise.

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The average magneto is designed to have a good output of voltage at a speed of 120 revolutions. When starting an engine it is not likely that this speed will be attained. Consequently, no spark will occur and the engine will fail to start. A booster magneto is mounted on practically all airplane engines to provide easy starting. It has an output equal to that of the main magnetoes.

However, it is operated by a hand crank which is geared up giving it the necessary speed for a shower of good sparks required to start a cold engine. This voltage is distributed by means of a trailing arm on one of the main magnetoes which automatically retards the spark during starting. Once the engine fires it will speed up so that the main magnetoes will provide the ignition and the pilot ceases to turn the booster.

Sparkplugs are a constant source of trouble. No one plug has ever been designed to take care of all operating conditions. Good results are obtained by a careful selection of the plugs used. As in automobile practice both porcelain and mica insulation is used. On the whole the mica-insulated plugs are more sturdy. They will withstand knocks that would crack porcelain. Moreover, they will not crack under a quick change of temperature.

The sparkplugs operate in a combustion chamber that frequently reaches a temperature of 4000 degrees Fahrenheit. These conditions are naturally severe. If the plug gets too hot, it will become incandescent and cause preignition; that is, the fuel will be ignited by the hot spot rather than by the arcing voltage. On the other hand, if it cools off too quickly, lubricating oil which has slipped past the piston rings will collect on the electrodes forming an insulation that will cause the plug to miss.

The heat is controlled by means of cooling fins and by the length of the center electrode. It is up this spindle that the heat escapes. If the distance the heat must travel is increased, naturally the plug will get hotter. Thus, engineers are able to design a plug for nearly any operating temperature.

To give good service the plugs must be kept clean and the gap must be kept properly set. The best results will be gained with a 0.015 inch gap for airplane engines.

The ignition leads must be very flexible in order to follow the rough contours of the engine. Heat, oil, and sunshine will cause the rubber insulation to disintegrate quickly, so the leads are kept inside the cowling as much as possible.

Every time the sparkplugs or the breakerpoints open electric waves are generated that act exactly as small radio spark sets. With the modern use of radio on planes these waves cause considerable interference which results in a loud hum in the earphones. To eliminate this the entire ignition system is enclosed in metal coverings which absorb the waves and return them to the ground. This is called shielded ignition.

If the sparkplugs are kept clean, the breakerpoints kept smooth, polished, and set at 0.012" clearance, the ignition system will seldom cause a pilot any trouble. The added feature of having two distinct systems lends even a greater percentage of reliability.

The fifth article of this series will deal with lubrication—its theory and practice. Methods of lubrication will be discussed as well as the various qualities desired in good oil.

Collishaw of Canada

(*Continued from page* 12)

another, and the four remaining machines turned tail for home. Within sight of thousands of French soldiers in the trenches, his amazing feat was quickly reported to the French authorities, who decorated him on January 24, 1917 with the Croix de Guerre.

Immediately afterwards Collishaw was successively transferred to a naval squadron operating near Cambrai, more than 150 miles to the north, and later to Dunkirk, where he had considerable combats and increased the number of his victories.

His eighth victim was a German seaplane which he sent down into the Ostend Basin during the famous bombardment at Zeebrugge, noted Belgian coast town. This was his last victory over the sea for nearly seven months. Already he had won great distinction as a fighter in the naval squadron and when the great British attack at Messines Ridge was imminent, the call for able fighters came and Collishaw was again transferred, this time to Droglandt, to the south of the area being attacked.

Heretofore the Canadian flyer's meeting with the enemy had been incidental to his chief duty as escort to bombers and the planes of the battle fleet, but now his principal mission was to seek out the foe wherever he could be found.

Collishaw's appearance belied the tenacious fighter he was—a good-humored, care-free smile always on his lips — but one could see on closer observation the keen eyes which indicated that here was not a careless soldier of chance but one who planned carefully and then calmly resigned himself to destiny.

For two months at Droglandt every day was fraught with action. No less than twenty-nine planes were brought down from May 3 to July 27 by this smiling youngster of twenty-three. Only von Richthofen exceeded this number over the same period, but the amazing difference between the two was that the German ace's victims were in the majority slow observation machines, infinitely inferior to his Fokker, while twenty-three of Collishaw's twenty-nine were fast, well-armed fighters. Yet the name of Baron von Richthofen was on everyone's lips, while Collishaw quietly went on his way, hardly known even to the British airmen in France.

Collishaw's reward for his achievements was the command of a flight of ten naval squadrons, which soon enabled him to display his remarkable qualities of leadership and tactical knowledge. Few aviators ever covered such a wide field in the war—he had already shot down the enemy on land, over the sea, near Messines, just to the south of the famous Ypres Salient, on the Somme, and as far south almost as the

(*Continued on page* 44)

Win a Flying Course!

(*Continued from page 6*)

and ACCURACY are two of the most important factors in the contest.

Remember that the Flying Course will enable you to sit for a private pilot's license, but that the obtaining of such a license is up to you—your own ability, etc.

Remember that the first prize winner will be trained by the *Curtiss-Wright Flying Service*, the most reliable and safe in the country, and in a Curtiss-Wright *Junior* light-airplane.

Don't forget your Student Permit. That is as necessary to your taking the Flying Course, if you win, as eating is to live.

Do not send in your pictures until you have the six completed. We will give you ample time to mail them.

Be sure to send in your entry blank. If your name isn't on our list your entry blank will not be considered.

Finally we come to the judges for the contest. Mr. Harold Hersey, publisher, and Capt. H. J. Loftus-Price, editor, of MODEL AIRPLANE NEWS are the judges. Mr. "Casey" Jones is the referee.

All right. Now, let's hear something from you. Start right in with them. Don't rush it, and don't get flustered.

Rules

1.—*There is no entry fee.*

2.—*No correspondence will be entered into concerning the contest.*

3.—*This contest is open to all readers of* MODEL AIRPLANE NEWS, *whether subscribers or otherwise.*

4.—*Members of* MODEL AIRPLANE NEWS' *staff and/or the employees of Good Story Magazine Co., and/or the Curtiss-Wright Corporation and its subsidiaries are not eligible for entry in the contest.*

5.—*The Judges' decision is final. The judges are Harold Hersey, publisher, and Capt. H. J. Loftus-Price, editor,* MODEL AIRPLANE NEWS, *and referee, Mr. C. S. (Casey) Jones, the Curtiss-Wright Corporation.*

6.—*The contest closes at midnight November 21, 1931. After that time no entries will be eligible for a prize.*

7.—*The names of the winners will be published in the first possible issue of* MODLE AIRPLANE NEWS *after the closing date of the contest.*

8.—*Should two or more persons tie for prizes, each will be awarded the prize tied for.*

9.—*In competing for the prizes, each contestant releases* MODEL AIRPLANE NEWS, *the Good Story Magazine Co., the Curtiss-Wright Corporation and/or their subsidiaries from any and all responsibility insofar as mishap of any kind is concerned.*

10.—*The winners of the first, second and third prizes agree to pay their own transportation and living expenses during the course and flight.*

11.—MODEL AIRPLANE NEWS *will not be responsible for receipt of entry forms and/or finished contest pictures. Proof of postage does not signify proof of receipt.*

Collishaw of Canada

(Continued from page 42)

Swiss frontier.

A pitched battle on June 6, 1917 brought Collishaw three victories to raise his total to sixteen and win for him his second decoration, the D.S.C. Far from the general opinion that von Richthofen was the first to instigate massed formation flying on the western front, he was actually following the example set by Collishaw, who was then leading massed attacks in the air. In fact it was a month later when von Richthofen formed his famous "Flying Circus" and sent its red fighters out in massed formation. Collishaw's triple victory came during his first flight over the lines early on that June morning. In an all-black Sopwith triplane, which he affectionately called, "Black Maria", he led the entire squadron of similarly colored machines on an offensive patrol.

At once they encountered a German squadron of Albatros scouts. The fighting was terrific as nearly forty of the fastest fighters of the two armies flashed back and forth in the sky. Collishaw took on the enemy leader and after a short combat, the German went down in flames. Immediately Collishaw turned just in time to see one of his own scouts attacked by an Albatros while engaged in fighting off another German plane.

Collishaw opened his throttle wide and dived, firing steadily at the enemy. It fell. He turned to attack another Albatros and killed the pilot instantly. The third Albatros turned on its back and crashed. Such damage following so quickly after the meeting compelled the Germans to turn tail, leaving the doughty 210th Naval Squadron to go merrily on their morning patrol.

By July 3 Collishaw's third decoration, the D.S.O., had been bestowed on him, immediately following a dramatic encounter with one of von Richthofen's men, whose name went down as Collishaw's twenty-first victim. Then von Richthofen's second in command, Lieut. Karl Allmenroeder, who had the day before brought down 2nd Lieut. Nash, one of Collishaw's own men, was the next to fall under Collishaw's fire. Nash (months later discovered to be a prisoner of war in Germany) was Allmenroeder's thirtieth victim and made Collishaw's act of reprisal a great victory.

While these mounting achievements may seem a series of unobstructed successes, this was not the case. Collishaw's life was in great danger every moment since his squadron was not one which resorted to spasmodic attacks to keep the enemy in check, but was so situated that their only course was steady, day-by-day fighting. Several times he had miraculous escapes from death. Once under the fire of a Fokker scout he barely succeeded in crossing his own lines before crashing. On another occasion his machine was so badly shattered by gun fire from the German trenches that on landing he discovered that even his goggles were shattered.

An amusing incident is worth telling. One time in a new machine he lost his way in a heavy fog and mistook a German airdrome for his own. He landed. Imagine the shock he received when looking round he saw the famous black cross of Germany on the fuselages of several machines lined up on the tarmac. Greycoated Germans dashed out to take their prisoner and were only a few feet away when he rammed his throttle full forward and his wheels lifted from the ground. He was off again, amid the sharp staccato of machine-gun fire from the airdrome gun-pits!

Twice within three days, between July 15 and July 17, Collishaw suffered the hair-raising experience of being shot down out of control, but his luck remained with him and both times he was not even bruised. Still grinning, each time he got into another plane and on July 20 he added still another victory, duplicating the same feat the next day.

Then he received a short leave and with no publicity attending his visit, he returned to Canada. Scarcely anyone knew that in their midst was a young man who was already one of the premier aerial fighters of the war.

In a short while he was back at the front and was appointed to command No. 13 Naval Squadron, which was operating from Dunkirk along the coast with the fleet. Again his task was to watch for submarines, to protect the battle fleet and the observation planes which directed by wireless the gunfire of the ships over Zeebrugge and Ostend, and, when the opportunity arose, to bomb the submarines and their repair shops in the harbor.

His first victory over the sea since the episode over Ostend Basin on May 13 took place on December 1, and by July 4 he had destroyed a total of forty-six enemy machines. On that day his forty-seventh victory resulted in the award of the Distinguished Flying Cross. At nearly 20,000 feet in the air he unsuccessfully attacked six Fokker triplanes. Undaunted, he left their vicinity in search of more reasonable prey. He was rewarded in a moment or two by the sight of two D.F.W.'s flying below him. Diving quickly, he swooped on the higher of the two. After a desperate struggle it turned over completely and fell on its companion which was coming to its assistance. The two machines locked in a death embrace and crashed far below. Collishaw received credit for only the one machine he had shot down.

By this time the Canadian held the rank of major and was still in command of the same naval squadron, now known as No. 203 Squadron R.A.F. A still greater honor was to come to him after a tremendously brilliant victory on July 22. In the company of another pilot he took off at 4 A.M. to attack a German airdrome at Dorignies. Dropping low in the darkness, they bombed the hangars which immediately took fire. The confusion was terrific. The startled enemy rushed out with a number of single-seater Albatros machines which they attempted to get into the air, their only illumination being the flickering lights caused by the burning hangars. The fire was now spreading to the men's quarters, which were riddled with machine gun fire and bombs from above. Five times the two flyers dived down and attacked the Albatros machines, wounding a number of the enemy. The place was now a blazing inferno.

Suddenly one of the enemy's night flying bombers on its return flight appeared with full lights on. It was unaware that the raiders were still in the vicinity, and

the lights betrayed it. Collishaw attacked and it crashed to the ground in flames. The two marauders then prepared to set out for home, but several yards away they discerned a horse-drawn transport moving along the road to the front. Swooping down to about 50 feet from the ground, they attacked it and the whole transport stampeded.

Then their eyes fell on some German troops at a railroad station. They immediately ground-straffed them and many fell under the vicious hailstorm of machine-gun fire. At 5:45 the two flyers were back at their own airdrome.

Collishaw returned later to investigate the extent of the damage they had done to the German airdrome. On turning for home he was suddenly attacked by three Albatros scouts. Thinking he was trying to escape, the Germans pursued him into the British lines. They had been hoodwinked! Collishaw had been maneuvering for position all the time and suddenly turned and attacked the leader. He went crashing down out of control, making his name the fifty-first on the Canadian ace's list of victories. Truly a red-letter day for Collishaw!

The victories kept mounting into September. Then one day Collishaw decided to leave his calling card at another German airdrome, this time paying a visit in the afternoon. He led his fourteen men, now flying Sopwith *Camels*, across the lines to the enemy's lair. They bombed all the hangars and a number took fire immediately. About twenty Germans rushed helter-skelter out of the living quarters toward the town for shelter and many were killed by the flyers above them. By this time all the hangars, workshops and living quarters were in flames and Collishaw led his men home.

On the way back they were accosted by a formation of fifteen Fokkers, one of which Collishaw shot down. The rest dispersed. Collishaw's victories totaled sixty now. Seventeen more followed to bring his total to seventy-seven.

Then Collishaw returned to England to participate in the organization of the Royal Canadian Air Force. It was while he was there that the armistice came. During his stay he had been promoted to the rank of Lieut. Col., and this was the rank he held when he left for Canada at the cessation of hostilities, only to return to England once more when it was decided to send a British squadron to the support of Deniken who was trying to overthrow the Bolshevist regime in Russia.

Collishaw was now twenty-seven years of age and had been contemplating a Transatlantic flight when he was offered the command of the squadron. His adventurous blood tingled at the prospect of more fighting and he abandoned the flight across the Atlantic to go to the South Russian front.

As this is a brief sketch of the achievements of Collishaw during the World War, details of his commendable career thereafter in Russia, Egypt, Persia and the Holy Land need not be gone into. Suffice it to say that this great veteran of the skies is now bearing the proud title of Wing Commander and still modestly adding his bit to the fame of the British Royal Air Force.

Aviation Advisory Board

(Continued from page 35)

ally in demand, especially those that have a detailed practical knowledge of airplane rigging and repair and engine operation, maintenance, and overhaul. Such experience can not be obtained in a short time nor by theoretical application, but must be acquired by combining theory with hours of practice under service conditions. The department requires that applicants for mechanics' licenses shall have had at least two years experience on internal combustion engines, one year of which must have been on aircraft engines.

As the industry grows, good aeronautical engineers will always be needed, as will manufacturing experts and shopmen, but here, as in other phases, special training must be acquired.

The airport designer is a specialist of a different sort. He should possess a thorough knowledge of flying in order to see proposed airport sites as with the eyes of a pilot. Assuming this experience and basic engineering education, and sufficient study of airports and their peculiar engineering problems, the airport specialist will have the foundation for obtaining a valuable place in the industry.

Airport ground men, as discussed here, do not include executives, traffic men, etc., but are usually helpers with ordinary experience and no special training. Their chances for advancement depend upon themselves and the agreements which they have with their employers. These ground men usually perform miscellaneous work without engaging in actual flying.

The positions of traffic agent, advertising and publicity man, and salesman all require a working knowledge of flying combined with some special talent for the particular work chosen. Such opportunities will increase with the growth of the industry, but probably these men will be recruited from the ranks of pilots who have found that their special abilities along these lines outweigh the advantages of continuing in piloting alone.

The executives of aviation will necessarily be chosen from those combining knowledge and experience in several of the more important of these phases.

The opportunities in the Government service can be more specifically outlined. Enlistment in the Army, Navy, Marine Corps, and Coast Guard for aviation duty will usually afford some chances of close contact with flying, but the services do not usually provide actual flight training in the case of ordinary enlistment. Appointment to one of the Army cadet schools will give the student a chance to complete a very thorough course as a cadet, after which he will be commissioned as a second lieutenant in the Air Corps Reserve and will ordinarily be put on inactive duty. He can then take up work in commercial aviation if he so desires. Details as to this course can be obtained from the Chief of the Army Air Corps, Munitions Building, Washing-

ton, D. C., which office also dispenses information in regard to enlistment in the regular service of the Air Corps.

The matter of entering the *Naval Reserve Force* is covered in Circular No. 803-19, issued by the Bureau of Aeronautics, Navy Department.

Details of enlistment in the *Navy, Marine Corps,* and *Coast Guard* may be obtained, respectively, from the Bureau of Aeronautics, Navy Department, Marine Corps Headquarters, Navy Building, and the Coast Guard, Treasury Department, all of Washington, D. C.

Methods of Acquiring Training and Experience

The usual plan in this case is to obtain instruction at one of the commercial flying schools in the country. There are several hundreds of these now listed in the Aeronautics Trade Directory of the Department of Commerce, but the department has not established a rating system for these schools.

Another system of learning to fly is becoming more and more popular in this country. This is the flying-club method. Members of flying clubs usually include men and women who are unable to purchase planes independently and to hire instructors to train them. They also include those who are unable to spend several months at training schools and who have only a few hours each week in which to receive instruction.

The military and naval services offer opportunities for acquiring training and experience as previously outlined.

A recognized method of securing experience as an aeronautical engineer is to attend a college or university with a complete course in aeronautical engineering. Graduates of these schools should supplement their theoretical and laboratory training with certain practical experience before they are ready to take up regular engineering work.

The manufacture of airplanes and airplane engines is a specialized field. Designers and constructors are ordinarily taken from the ranks of recognized aeronautical engineers. Factory riggers and mechanics are usually those who have obtained experience in rigging at commercial airports or in the military and naval services. Welders who are now used in building steel tubing fuselages usually are employed for their welding ability rather than for aeronautical training. Some factory men begin as helpers in order to learn this trade and acquire experience in the same manner as in any other factory.

The airport designer, as previously described, must combine engineering experience with practical knowledge of flying. Steel construction experts find their training valuable in hangar work. Road builders may find opportunities in the construction of runways. There is need for men with electrical knowledge to install and maintain lighting systems at airports.

The airport designer and constructor is a man who has a fair knowledge of all these phases, and in addition an understanding of meteorological conditions so that he may choose good sites for the airports he builds.

Traffic agents, advertising and publicity men, and airplane salesmen usually have previous experience in one of the three lines indicated besides a fair knowledge of aviation in general. Perhaps the best way to work into these positions is to enter one of the other branches of the industry and later to specialize along the desired line.

Choosing the Training School

Before enrolling the student should take the physical examination which is required before this department can issue a student permit for instruction in licensed planes. The air commerce regulations prohibit instruction in licensed planes without such a permit, so that before going any further the prospective student should not fail to assure himself that he is physically qualified.

The names of the proper physicians designated as examiners by the department can be secured from local flying schools and airports, or upon application to the Medical Director, Aeronautics Branch, Department of Commerce, Washington, D. C.

In order to choose the training school which is best suited to his needs, the prospective student should make a careful study before deciding on any one organization.

If he resides near enough to any training school under consideration, he should visit it and observe the method of its operation. He should know what equipment it has for training its students and he should learn how many students are assigned to one pilot and one plane for instruction. Too many students assigned to one instructor will extend the period of instruction over an undesirably long period.

The prospective student should talk with the students and learn whether they are satisfied with the results they are obtaining. If possible, he should talk with pilots who have graduated from the school and should know whether they are steadily employed or successfully operating planes of their own.

He should study the course offered, both the theoretical and the flight instruction, and should compare this with courses offered by other schools. Particularly, the student should find out definitely what guarantee there is that he will be given flight instruction and in what period of time his training will be completed. If the wording of the contract or guarantee is not clear on this point, he should have it interpreted by some disinterested person.

To sum up, he should determine whether the school is run systematically, whether the students are satisfied, and whether there is sufficient evidence that the advertised course will be given as indicated.

If the student does not live close enough to the school or schools under consideration, he should write for full details of the courses offered. These may be compared and if they are not sufficiently clear, the student should correspond further and insist on definite answers to questions which are in doubt.

It would be in order to correspond with graduates, if possible, learning where they are employed for the purpose of determining whether they have succeeded on the basis of the instruction given by the school attended.

If there is difficulty in obtaining any of this information, particularly in case the student is not able to visit the school, he may write to the chamber of commerce of the city concerned or to the Better Business Bureau of the city for an expression of opinion as to the merits of the organization being considered.

The Department of Commerce has not established a rating system by which these schools can be compared, and this may not be done for some time in the future. However, one aid which the department offers as a guide is its air commerce regulations. The better flying schools conform gladiy with these regulations and they prepare their graduates for at least a private pilot's license, in addition to furnishing the ground work which will enable them to pass the examinations for higher licenses. The air commerce regulations should be studied carefully by students before entering commercial schools, so that they will be fully acquainted with the requirements of the department and can judge whether the school concerned can qualify them for these licenses.

The average training school gives 10 hours of dual instruction and one or two solo flights. The student who completes this training is by no means ready to enter the industry as a trained pilot. He is equipped merely to continue solo practice. He should be in a position to continue flying regularly, either by paying for practice flights, by arrangement with an operator whereby he works in exchange for training, by purchase of his own plane, or in a flying club.

He should not consider that he will be able to secure a position with an operator on the basis of his ability to fly alone at the end of 10 hours' training. He has only begun the aviation business and he should obtain at least 50 hours' solo experience before he attempts even the carrying of passengers at an airport. At the expiration of this period the new flyer may begin to carry passengers and thus add to his experience so that at the end of 200 hours he may be able to pass the Department of Commerce examination for a transport license.

It should be remembered that a 10-hour training period which can not be followed at once by regular practice will be of little value to the student. The method of continuing this training should be decided and ready to be put into effect before beginning the training period. Otherwise the student may have to take additional training later, on account of his first instruction having been partially forgotten.

The department has received inquiries from younger boys in regard to the best course to follow in entering aviation or in acquiring a general knowledge which will be useful later in taking up actual flying.

A general study of aeronautical books and bulletins will give a fair picture of the aviation industry. The department's Aeronautics Bulletin No. 6 contains a list of Government and private publications which should be useful.

Model airplane clubs have already proved their value. High schools are now establishing aviation courses on account of the insistent demand for this instruction by their students. This is good background for later development. It is possible that some students will be able to spend their vacations or a part of them at airports or other bases of flying activities watching operations and perhaps even performing minor services at the airports in order to obtain general knowledge.

Such experience will be invaluable if the prospective student of aviation later enters a university with an aeronautical course or even if he enters a regular commercial school for flight training.

The following extract from a bulletin of the Daniel Guggenheim Fund for the Promotion of Aeronautics (Inc.), a nonprofit-making organization, is quoted as of probable interest to those seeking to enter the aviation industry. It represents the opinion of important men in aviation, including Col. Charles A. Lindbergh, F. Trubee Davison, Assistant Secretary of War for Aviation, Harry F. Guggenheim, Dwight Morrow, and other members of the Daniel Guggenheim Fund.

Need for Aeronautical Engineers

Practically all the aircraft manufacturers, except in three instances, employ graduate engineers in their engineering departments. The number employed ranged from a single graduate in the smaller companies to as many as 51 in a very large company, the average number being 4. But while a technical education was deemed essential, less than 17 per cent of the graduate engineers employed had pursued specialized courses that led to a degree in aeronautical engineering.

Aeronautical graduates are especially needed in engineering departments where a knowledge of draftsmanship and structure is considered desirable. For positions such as shop foremen, previous aircraft manufacturing experience is the most important requisite, but for the higher positions involving a thorough knowledge of design, stress analysis, etc., a specialized education is a necessary qualification.

Pilots—Education and Training

"What is the character of the general education of the pilots in your employ?" air transport companies were asked. Eight replied that most of their pilots were high school and college graduates who had had aeronautical training. When these pilots were employed, they already had an average of more than 1,000 hours of flying to their credit. Five hundred hours of flying time is the minimum required of new pilots by air transport companies.

Most pilots received their training in the Regular Army or Navy or in the reserve corps. A few pilots gained their experience in the commercial field after a solo flight. The most desirable experience for their pilots, as the air transport companies see it, is a combination of Army and commercial training. Barnstorming, night and cross-country flying in bad weather afford desirable experience to student pilots.

Qualifications for Ground Engineers and Mechanics

Positions as ground engineers and mechanics are open to a wider field of applicants. In the first place, the number employed is much greater than the number of pilots. Taking the reports of the eight air transport companies, the smallest number of ground mechanics employed by a single company was 2 and the largest number was 104; the average number was 26.

The general education of these men includes high-school training, and in some instances they are graduates of a college or technical school. High-school training seems to be the minimum educational qualification. Their mechanical experience covers general and special aviation shopwork in addition to field aviation experience. They are all licensed by the Department of Commerce except those who are helpers.

CO2 Gas Engine

(*Continued from page 27*)

ineffective) or hang down from same. In the latter case the (Sparklets) cylinders are loaded into the fuselage through the bottom, and in the former case the cylinders are passed aboard the model through the top side of the fuselage body.

Other arrangements may suggest themselves to the reader, such as hinging a part of the side of the fuselage and laying the cylinders in, as convenient for his own particular installation. These points on the arrangement of the Sparklets are merely suggested and may be modified in many ways to suit the individual desire without any loss of efficiency or causing a reduction of power to the engine.

The use of six Sparklet cylinders as described above should, at a very conservative estimate, keep the model craft in the air one hour and six minutes using the ½" stroke, ½" bore model aircraft engine.

Complete Course in Aerial Radio

(Continued from page 15)

LIST OF ABBREVIATIONS TO BE USED IN RADIO TRANSMISSIONS

(International Conference of 1927)

Q CODE.

Abbreviations more especially used in aircraft radio service.

Abbreviation	*Question*	*Answer*
QAA	At what time do you expect to arrive at ....?	I expect to arrive at .... at .... o'clock.
QAB	Are you en route to ....?	I am en route to .... or, Go to ....
QAC	Are you returning to ....?	I am returning to ...., or Return to ....
QAD	At what time did you leave ....? (place of departure)	I left .... (place of departure) at .... o'clock.
QAE	Have you news of ....? (call signal of the aircraft station)	I have no news of .... (call signal of the aircraft station).
QAF	At what time did you pass ....?	I passed .... at .... o'clock.
QAH	What is your height?	My height is .... feet (or metres).
QAI	Has any aircraft signalled in my neighborhood?	No aircraft has signalled in your neighborhood.
QAJ	Must I look for another aircraft in my neighborhood?	Look for another aircraft in your neighborhood (or) Look for .... (call signal of the aircraft station) which was flying near .... (or in the direction of ....) at .... o'clock.
QAK	On what wave are you going to send the meterorological warning messages?	I am going to send the meteorological warning messages on wave length of .... metres (or kilocycles).
QAL	Are you going to land at ....?	I am going to land at .... (or) Land ....
QAM	Can you give me the latest meteorological message concerning the weather for ....? (place of observation)	Here is the latest meteorological message concerning weather for .... (place of observation).
QAN	Can you give me the latest meteorological message concerning surface wind at ....? (place of observation)	Here is the latest meteorological message concerning surface wind at .... (place of observation).
QAO	Can you give me the latest meteorological message concerning upper wind at ....? (place of observation)	Here is the latest meteorological message concerning upper wind at .... (place of observation).
QAP	Must I continue to listen for you (or for ....) on .... metres (or kilocycles)?	Continue to listen for me (or for ....) on .... metres (or kilocycles).
QAQ	Will you hasten the reply to message No. .... (or in accordance with any other indication)?	I hasten the reply to message No. ...., (or in accordance with any other indication).
QAR	Must I reply to .... for you?	Reply to .... for me.
QAS	Must I send message No. .... (or in accordance with any other indication)?	Send message No. .... (or in accordance with any other indication).
QAT	Must I continue to send ....?	Listen before sending; you are interfering.
QAU	What is the last message received by you from ....?	The last message received by me from .... is ....
QAV	Are you calling me? (or) Are you calling ....? (call sign of the aircraft station)	I am calling you (or) I am calling .... (call signal of the aircraft station).
QAW	Must I cease listening until .... o'clock?	Cease listening till .... o'clock.
QAX	Have you received the urgent signal sent by ....? (call signal of the aircraft station)	I have received the urgent signal sent by .... (call signal of aircraft station) at .... o'clock.
QAY	Have you received the distress signal sent by ....? (call signal of the aircraft station)	I received the distress signal sent by .... (call signal of the aircraft station) at .... o'clock.
QAZ	Can you receive in spite of the storm?	I can no longer receive. I am going off watch because of the storm.

CRESCENT Flying Scale Models are GUARANTEED to FLY!

Special!

MATERIAL KIT

Enough material to build three light planes of your own design. Sent in strong mailing tube.

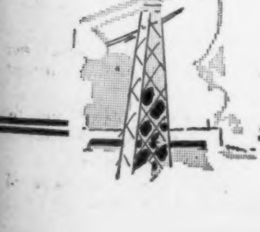
1.00 Post Paid

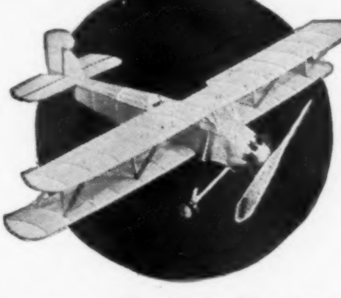
COMPLETE

Selected Balsa in 18" Lengths	Retail
1 pc. 1/32 x 2"	$ .05
1 pc. 1/16 x 2"	.05
6 pcs. 1/16 x 1/16"	.06
12 pcs. 1/8 x 1/8"	.12
2 pcs 1/8 x 1/4"	.06
2 pcs. 3/16 x 3/16"	.06
2 pcs. 1/2 x 3/4"	.12
2 pcs. 1/4 x 1/16 x 1/2" bamboo	.02
10 ft. 1/8 rubber	.10
5 ft. No. 8 music wire	.05
1 light and strong propeller hangar	.05
2 sheets 24½x20⅛ fine tissue	.20
2 ozs. Crescent special dope	.25
1 oz. Crescent cement	.15
1 pr. ⅞ balsa wood wheels	.10
12 very light brass washers	.10
4 small eyelets	.04
Total Regular Value	$1.50

Also included free, full size plans of the famous Flying Glory 27" cabin plane. We sell special parts needed for its construction.

No Bamboo or Reed used in Crescent Models. Complete material list sent on request.





Curtiss FLEDGLING

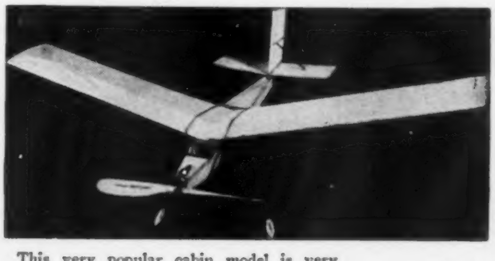
For the first time a perfect flying scale model of the famous navy training plane—the CURTISS FLEDGLING. Semi-constructed kit of this 22" wing spread ship. This model has been tested and proved for 300 foot flights, or better, by instructors and students at many schools and airports. This wonderful model really flies.

This kit contains all parts semi-finished as follows, semi-finished prop, nose block, all material cut to size and shape, instructions and full size drawings, enough dope, ambroid and Jap. Tissue. Weight of complete model 1 oz. Beginners who choose to build the Curtiss Fledgling for their first models have assembled them and had them flying in a short time.

1.95 Post Paid

Complete

CABINAIRE, JR.



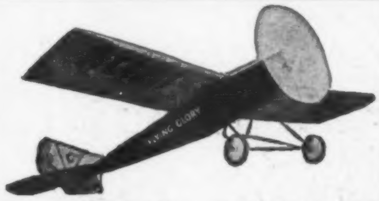
This very popular cabin model is very easy to construct and can be built ready for flying in less than 2 hours. It is an indoor and outdoor flyer and can be flown from the ground or hand launched. It has a wing span of 24", an endurance of 1½ to 2 minutes. Semi-finished kit included all necessary materials, semi-finished prop, instructions and full size plans.

1.00 Post Paid

Complete

Crescent Model Aircraft Co.

1807 Benson Ave., Brooklyn, N. Y.



FLYING GLORY

Our Flying Glory is the most famous contest winner in the country, having flown 1,500 ft. and guaranteed for consistent flights of at least 500 feet. Flying Glory, while keeping all the proportions and appearances of a real plane is not a copy of any particular one—but is primarily designed for FLYING PERFORMANCE.

A few features of Flying Glory:

Special V bottom fuselage for minimum wind resistance and stability. Detachable wings for flight control. Removable nose piece for allowing easy adjustment for speed or distance flights. Solid balsa wood fuselage sides for lightness and strength. This new improved type Flying Glory is positively shock-absorbing. It is a simply constructed model.

Kit contains everything with full size plans and many parts, ready made. Prop semi-finished. No cabin monoplane model like it anywhere for flying, durability and fine appearance.

1.95 Post Paid

COMPLETE

IMPORTANT!

Watch for Early Announcement of the Sensational

CURTISS HELLDIVER

Flying Scale Model.

Another model designing triumph of I. Sturiale.

Curtiss FALCON

The Curtiss Falcon is the finest Flying Scale Model ever produced from a commercial kit! The plane illustrated (above) was built by a 13-year-old boy from one of our regular sets without assistance. You can easily do as good a job by following the simple full size diagram and instructions in the kit.

Model has 17 in. wingspread, ¾ ounce weight. Ribs, nose block, metal parts, radiator, sides, etc., are all either partly or entirely finished. Full size plans, celluloid wheels, extra dope, etc., included. You will be flying this model in a short time after you receive your kit! The correctly finished plane must fly 200-400 feet or Your Money Back.

Capt. H. J. Loftus-Price, editor of Model Airplane News, has personally flown and inspected the same Curtiss Falcon model shown here and certifies that it has his full approval and recommendation as to flying performance and accurate scale reproduction of the real plane.

1.95 Post Paid

COMPLETE

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the dark. THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. Anyone—you can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons or switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Small bottle, price 25c. Larger sizes, 50c and $1 postpaid. JOHNSON SMITH & CO. Dept. 975. RACINE, WIS.

STAGE MONEY

With a bunch of these imitation bills you can appear prosperous. By flashing a roll of these bills and peeling off a real one from the top, effect will be all you desire. 40 Bills 20c., 120 for 50c., $3.50 thousand p. pd.

Skull and Crossbones Ring Very striking, quaint and uncommon. Silver finish; two brilliant, flashing gems sparkle out of the eyes. Said to be a lucky token. Only 25c postpaid.

Exploding Cigarettes

Box contains ten genuine cigarettes of excellent quality. They appear so real, but when each cigarette is about one-third smoked, the victim gets a very great surprise as it goes off with a loud BANG! A great mirth provoker yet entirely harmless. Price 25c box.

THE DANDY PERISCOPE

Very Interesting and Amusing Novelty

SEE WITHOUT BEING SEEN

Look Over the Heads of the Tallest Men in a Crowd.

See Over a Fence, Around Corners, Etc.

LOTS OF FUN AND AMUSEMENT

Strongly Made. Equipped with Mirrors, Sight-Finder and Eye-Piece.

THIS is the same kind of instrument that the soldiers use in the trenches to watch the enemy without risk of being seen themselves, and every submarine has one to project above the surface of the sea to keep a look-out for other vessels, etc. With it you can gaze over a high wall or see around a corner without being seen yourself, or, if you are in a crowd, you can look right over the heads of the tallest men and watch all the fun. Our illustrations will give you some idea as to the numerous uses to which the Periscope can be put. Every Boy Scout should have one for spying and anyone else who wants some rare amusement. The Dandy Periscope is very strongly made, will stand the roughest handling and the hardest wear, and with ordinary use should last a lifetime. It measures 17 inches long, and a little over two inches wide. The Periscope Tube is handsomely decorated with colored designs to show many of its uses, and each Periscope comes complete in box.
Price Postpaid to any Address $1.00

NOVELTY BADGES

Kissing Permit 10c *Garter Inspector 10c*
Two very novel metal badges, nickel plated, that you can wear, giving you fun out of all proportion to their trifling cost: 10c. each badge, 3 for 25c, or 75c per doz. postpaid anywhere.

STAR TOY MAKER

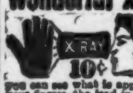
Greatest boys' book written. Tells how to make a Pinhole Camera, a Canoe, model Railroad, a Telephone, Boomerang, Telegraph Instrument, Box Kite, Talking Machine, Microscope, Electric Motor, Electric Door Bell, Water Wheel, Paddle Raft, a pair of Skis, a Dog Sled, Bird House, Rabbit Yard, etc. 64 pages. 150 illustrations. PRICE 10c.

AMATEUR ELECTRICIAN, all about electricity in simple language. How to make batteries, dynamos, motors, telephones, bells, electric coils, engines, lights, etc. Price 10c postpd.

SURPRISE MATCHES

More fun than fighting with your wife. Look just like ordinary matches. Put up in boxes just like regular Safety Matches. 10c
As the victim tries to light one he gets quite a surprise.
Price 10c per box, 3 boxes for 25c, 12 for 75 cents.

Wonderful X-Ray Tube



A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. Price 10c, 3 for 25c, 1 dozen 75c. Johnson Smith & Co.

ROLMONICA

$1.50

A Mouth Organ that Plays with a Music Roll

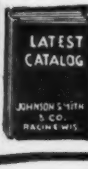
Any One Can Play It Without Practice A Wide Selection of Rolls to Choose From

All the Latest Broadway Hits

The Pocket Player Piano

A Veritable Pocket Size Jazz-Band!

Rolmonica is an automatic harmonica, that plays a music roll just like a player piano. It is a whole brass band all in one—the biggest sensation of the musical world in the last few years. Anyone can play it, for all you have to do is to insert a roll, and turn the handle while you blow. That is all there is to it. Nothing could be simpler. Any child who can do these two simple things can play the Rolmonica. It is a veritable pocket size Jazz-Band, combining the principles of the harmonica and the player piano. It is an instrument of a thousand melodies, it plays the popular airs of the past, as well as the latest Broadway hits. There are hundreds of rolls to select from, such as My Blue Heaven, Home Sweet Home, America, Old Black Joe, Annie Laurie, Sidewalks of New York, Humoresque, Wild Irish Rose, Rosie O'Grady, Among My Souvenirs, Love's Old Sweet Song, Dixie, Mighty Lak' a Rose, Aloha Oe, Ramona, Juanita, Rose Marie, Onward Christian Soldiers, Sally of My Dreams, Carolina Moon, I Faw Down & Go Boom, Weary River, Over There, Ma Cherie, Long Way to Tipperary, Make Believe, Desert Song, La Paloma, Sweet Adeline, I've Got a Feeling, Pagan Love Song, When My Dreams Come True, Parade of Wooden Soldiers, Land of Sleepy Water, Turkey in Straw, Hail the Gang's All Here, and hundreds of others. An unfailing source of amusement. You can delight your friends for hours and play tune after tune simply by changing rolls. Small in size, fitting your pocket, yet mighty in its finger-tickling, toe-tingling tune power. Not a toy, but a genuine musical instrument and the life of any party. One Roll free with each Rolmonica. Extra Rolls always obtainable; complete list with each instrument. New Rolls added each month. Price with 1 Roll $1.50; Extra Rolls 10c each, all postpaid.



A De luxe Edition of our new Catalogue mailed on receipt of 25c. Handsome binding. Bigger and better than ever. Only book of its kind in existence. Nearly 650 pages of all the latest tricks in magic, the newest novelties, puzzles, games, sporting goods, rubber stamps, unusual and interesting books, curiosities in seeds and plants, etc., unprocurable elsewhere. Remit by Stamps, Coin, Money Order, Check, etc. Canadian and Foreign Stamps also accepted.

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Well made and effective, modelled on latest type of Revolver; appearance alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridge—obtainable everywhere. Special cash with order offer: 1 Superior quality Blank Cartridge Pistol, 100 Blank Cartridges, and our new 550 page De Luxe Catalog of latest novelties; all for ONLY $1.50. Shipped by Express only. Cannot go by parcel post. Extra Blank Cartridges 50c per 100. Special Holster (Cowboy Type) for pistol 50c. No C.O.D. shipments.

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Into a trunk, under the bed or anywhere. Lots of fun fooling the teacher, policeman or friends.

The VENTRILO

a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Anyone can use it. *Never fails.* A 16-Page Course on Ventriloquism and the Ventrilo...... **ALL FOR 10 Cents**

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Wonderful Instrument.

Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, Curious and interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a pocket Mirror, and a Laryngoscope—for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail. Only 35c or 3 for $1.00

125 TRICKS WITH CARDS

Containing all the tricks and deceptions with cards ever invented, including the latest Tricks of the most celebrated Conjurers, Magicians and Prestidigitators popularly explained, simplified and adapted for home amusement and social entertainments. The whole so explained, that any one can, with a little practice, perform the most difficult feat, to his own satisfaction and to the wonder and admiration of his friends. There is also added a Complete Exposure of all the Card Tricks made use of by Professional Card Players and Gamblers. Shows how "Skin" Gamblers cheat and win money by their infernal "palm fling" and other tricks. These features make it the best work ever published on Card Tricks. *Price 25c Postpaid.*

MICROPHONE TRANSMITTER BUTTON

$1.00 Postpaid

You can easily make a highly sensitive detectophone by using this Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. It is simple and inexpensive. You can install an outfit in your home and hear conversations being held all over the house. You can connect up different rooms of a hotel. This outfit was used by secret service operatives during the war. It is being used on the stage. It is ultra-sensitive and is the greatest invention in microphones. You can mount the button almost anywhere—card board boxes, stove pipes, stiff calendars, on the wall behind a picture frame, etc. Button is so light and small it cannot be detected. Persons can be overheard without suspecting it. You can listen in on conversations in another room. A deaf person in the audience can hear the speaker. Connected to phonograph, piano or other musical instrument, music can be heard hundreds of feet away. Button may be used to renew telephone transmitters; often makes an old line "talk up" when nothing else will. The ideal microphone for radio use; carries heavy current and is extremely sensitive. Amplifies radio signals. Countless other similar uses will suggest themselves. Experimenters find the button useful for hundreds of experiments along the lines of telephones, amplifiers, loud speakers, etc. Many fascinating stunts may be devised, such as holding the button against the throat or chest to reproduce speech without sound waves. PRICE $1.00.

MAGICIAN'S BOX OF TRICKS

Apparatus and Directions for a Number of Mysterious Tricks, Enough for an Entire Evening's Entertainment . . . $1.00

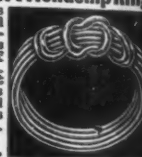
Anyone Can Do Them

It is great fun mystifying your friends. Get this Conjurer's Cabinet, and you will be the cleverest fellow in your district. It contains the apparatus for ten first-class tricks, including The MAGIC BALL AND VASE TRICK (a wooden ball is placed inside, and upon replacing the lid has disappeared and is found in someone else's pocket); The HINDOO TRICK CARDS (can be made to change completely no less than five times); DISAPPEARING COIN BOX (a coin, placed in the wooden box, vanishes entirely or changes into a coin of another denomination); The GLASS GOBLET TRICK (a coin is dropped into a glass of water and when the water is poured out the coin has vanished and is found somewhere else); the RIBBON FACTORY FROM THE MOUTH TRICK (a seemingly endless supply of colored paper ribbons comes out of your mouth); the DISAPPEARING HANDKERCHIEF (a handkerchief held in the hand mysteriously vanishes); the WIZARD'S RING COIN TRICK; the ENCHANTED BOTTLE (no one but yourself is able to make it lay down); the GREAT HAT AND DICE TRICK (a large dice is placed on top of a hat, disappears, and is found underneath yet no one has touched the hat); and last, but not least, the GREAT PHANTOM CARD TRICK, or two from five leaves nothing. Full instructions are sent for performing each trick. In addition to the above, a number of other feats and illusions are fully explained for which you can easily make or procure the necessary apparatus. Price complete $1.00 postpaid.

MIDGET BIBLE

GREAT CURIOSITY. Smallest Bible in the World. Size of a postage stamp. 200 Pages. Said to bring good luck to the owner. A genuine work of art. Must be seen to be appreciated. Make good money selling them to friends, church acquaintances, etc. PRICE 15c each, 3 for 40c, 12 for $1.25, 100 for $7.50. Also obtainable in Leather Binding, with gold edges. Price 50c each, 3 for $1.25, $4.50 per doz. Magnifying Glass for use with Midget Bible, 15c.

Lover's Knot or Friendship Ring



Made of 4 strands of genuine 14K gold filled wire, woven into the True Lover's Knot, symbolic of love or friendship. Very pretty, yet not showy. Each ring is made by hand by gold wire expert. It looks good and it is good. Price 50c Postpaid. Johnson Smith & Co.

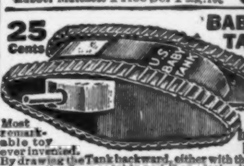
Rubber Chewing Gum

It is just like a regular package of chewing gum and looks so real that it fools everybody. Of course no one suspects it is not genuine until they start to chew it. There's a world of fun in this rubber chewing gum — 5 sticks to the package. Price, 10c Pkg.; 3 for 25c; 12 for 75c postpaid.

Rubber Cigarettes. Price per Box. 20c
Rubber Matches. Price per Pkg. 10c

BABY TANK

25 Cents



2½ inches long

Most remarkable toy ever invented. By drawing the Tank backward, either with the hand or over the floor or table and then placing it down it will crawl along, overcoming all obstacles, in the same life-like manner as the larger Tank that proved so deadly in the great war. What makes it go is somewhat of a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys, yet this tank will keep plodding along ten times longer than the ordinary run of toys. It will perform dozens of the most wonderful stunts. 25c prepaid.

ITCHING Powder

This is another good practical joke; the intense discomfiture of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more. 10c box, 3 boxes for 25c or 75c per dozen. Shipped by Express.

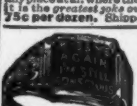
ANARCHIST BOMBS

One of these glass vials dropped in a room full of people will cause more consternation than a limburger cheese. The smell entirely disappears in a short time. 10c. per Box, 3 Boxes for 25c., 75c per doz. Boxes, or $7.50, per gross Boxes. Shipped only by Express.

SNEEZING POWDER

Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from another. Between the laughing and sneezing you yourself will be having the time of your life. For *parties, political meetings, car rides,* or any place at all where there is a gathering of people, it is the *greatest joke out.* Price 10c, 3 for 25c, 75c per dozen. Shipped by Express.

COMICAL MOTTO RINGS



Lots of harmless fun and amusement wearing these rings. Made in platinoid finish (to resemble platinum), with wording on enameloid, as illustrated. Price 25c ea. Postpaid

MAGIC MADE EASY **250 MAGIC TRICKS 10c**

An excellent little book containing 250 Parlor Tricks, tricks with cards, coins, handkerchiefs, eggs, rings, glasses, etc. So simple that a child can perform them. Profusely illus. Sent postpd. to any address for only 10c. 3 copies for 25c.

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